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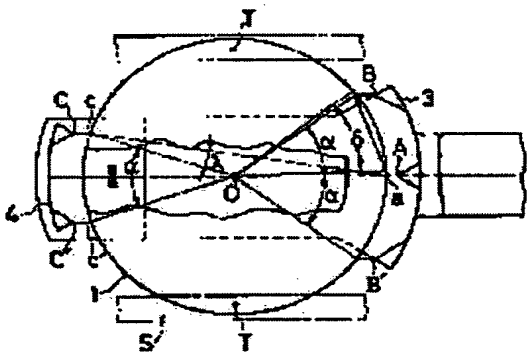
(54) HANDLING UNIT FOR SEMICONDUCTOR WAFER

(57)Abstract:
PURPOSE: To manufacture a semiconductor device with higher reliability by setting the positional relationship of holding section so that the center position of a wafer is specified to prevent the contamination of the rear side of the wafer.
CONSTITUTION: The opening angle 2α that the points B, B' at both ends of an arm side holding section make with respect to the center point O is set more than twice the opening angle (orientation flat angle) that the points at both ends of the orientation flat make with respect to the center point O of the wafer 1, and the contacting points are provided at the three points of both ends B, B' and the center point A. Moreover, the opening angle α that the points C, C' at both ends of the top side holding section make with respect to center point O is set more than the orientation flat angle δ, the contacting points are provided at the two points C, C' of both ends. The angle λbetween the line drawn between the point A on each section where both arm side holding sections 3 and the top side holding section 4 contact with the wafer 1 at the first time even if the orifra is in any position on the hand holding section (the line between a and c) and the center point O of the wafer 1 drawn between each point is set so that it is more than the friction angle between the arm side holding section 3 and top side holding section 4 and the wafer 1.



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CLAIMS

[Claim(s)]
[Claim 1] When grasping actuation of a semi-conductor wafer is completed, it has the central point in the location which projected the center position of the circle equivalent to a semi-conductor wafer periphery circle on the field parallel to a semi-conductor wafer side. The central point of the circle of the same diameter is mostly made into the aforementioned central point and homotopic. the center line on the flat surface passing through the central point can be used as the center line of a hand, and a semi-conductor wafer periphery circle can be fitted in and crowded -- It has a center section, respectively in the location of two points at which a circle and the center line of said hand concerned are crossed. It is the handling device of the semi-conductor wafer which made the predetermined range which met the circle concerned at the symmetry at the hand center line the semi-conductor wafer periphery section and the hand grasping section which can be contacted through each center section. The point of the both ends of the cage hula section of a semi-conductor wafer uses the aperture angle which the point of the both ends of the arm side grasping section of a hand makes to the central point as twice [more than] the aperture angle made to the central point of a semi-conductor wafer. Prepare a point of contact in the point of both ends, and three points of a center section at least, and the point of the both ends of the tip side grasping section of a hand the aperture angle made to the central point Even if it carries out to beyond the aperture angle that the point of the both ends of the cage hula section of a semi-conductor wafer makes to the central point of a semi-conductor wafer, it prepares a point of contact in two points of both ends at least and the location of a cage hula is located in which location of the hand grasping section in case a semi-conductor wafer is grasped, it comes out and both hand grasping sections with the line which actually contacts a semi-conductor wafer first, respectively, which will exist and which connected each one point at least The handling device of the semi-conductor wafer characterized by setting up the include angle which the line which connected each point to the semi-conductor wafer central point makes so that it may become beyond the friction angle of the hand grasping section and a semi-conductor wafer.
[Claim 2] When grasping actuation of a semi-conductor wafer is completed, it has the central point in the location which projected the center position of the circle equivalent to a semi-conductor wafer periphery circle on the field parallel to a semi-conductor wafer side. The central point of the circle of the same diameter is mostly made into the aforementioned central point and homotopic. the center line on the flat surface passing through the central point can be used as the center line of a hand, and a semi-conductor wafer periphery circle can be fitted in and crowded -- It has a center section, respectively in the location of two points at which a circle and the center line of said hand concerned are crossed. It is the handling device of the semi-conductor wafer which made the predetermined range which met the circle concerned at the symmetry at the hand center line the semi-conductor wafer periphery section and the hand grasping section which can be contacted through each center section. The point of the both ends of the arm side finger part of a hand the aperture angle made to the central point The point of the both ends of the cage hula section of a semi-conductor wafer makes it twice [more than] the aperture angle made to the central point of a semi-conductor wafer. Even the point which moved said beyond aperture angle of a cage hula towards the center section from each both ends is made into the hand grasping section. It carries out to four of the points which turned the point of contact in the center from both ends and there at least, and moved said beyond aperture angle of a cage hula. The point of the both ends of the cage hula section of a semi-conductor wafer uses the aperture angle which the point of the both ends of the tip side grasping section of a hand makes to the central point below as the aperture angle made to the central point of a semi-conductor wafer. Even if it makes a point of contact into two points of both ends, or one point of a center at least and the location of a cage hula is located in which location of a finger part in case a semi-conductor wafer is grasped, it comes out and both hand grasping sections with the line which actually contacts a semi-conductor wafer first, respectively, which will exist and which connected one point at least, respectively The handling device of the semi-conductor wafer characterized by setting up the include angle which the line which connected each point to the central point of a semi-conductor wafer makes so that it may become beyond the friction angle of the hand grasping section and a semi-conductor wafer.
[Claim 3] In the handling device of a semi-conductor wafer according to claim 1 or 2 The inclination of the field of the entry part of the upper part which a semi-conductor wafer enters in the longitudinal-section configuration of the contact section of the arm side of a hand and the tip side grasping section is made into the steep slope side turned centering on the semi-conductor wafer at the time of grasping a semi-conductor wafer. The interior which maintained the inclination until it reached the location near the diameter of the circular periphery of the flat base of a semi-conductor wafer, and went from it focusing on the hand The handling device of the semi-conductor wafer characterized by making an arm and tip side into the horizontally near conic gentle slope which went to the core from the height more nearly same than a hand flat surface.
[Claim 4] In the handling device of a semi-conductor wafer according to claim 1 or 2 The longitudinal-section configuration of the contact section of the arm side grasping section of a hand is made into a perpendicularly near internal surface in the upper part which is the semi-conductor wafer entry section. The part which went to the core from the height respectively more nearly same than a hand flat surface is made into a horizontally near conic gentle slope. Fix to a hand and this arm side grasping section carries out the longitudinal-section configuration of the contact section of the tip side grasping section in the wall and gentle slope same in the entry section as the arm side grasping section. The handling device of the semi-conductor wafer which makes the contact section of this tip side grasping section an unit or two or more grasping sections, and is characterized by considering as a part for the moving part lengthened or left toward the central point of a hand, or the arm side grasping section.
[Claim 5] In the handling device of a semi-conductor wafer according to claim 1 or 2 The longitudinal-section configuration of the contact section of the arm side grasping section of a hand is made into a perpendicularly near internal surface in the upper part which is the semi-conductor wafer entry section. The part which went to the core from the height respectively more nearly same than a hand flat surface is made into a horizontally near conic gentle slope. Fix to a hand and this arm side grasping section carries out the longitudinal-section configuration of the contact part of the tip side grasping section in the wall and gentle slope same in the entry section as the arm side grasping section. It stands up at a right angle to the direction lengthened immediately after just before

lengthening at the same time it considers as an unit or two or more grasping sections, and lengthens or leaves the contact section of this grasping section toward the core of a hand, or the arm side grasping section. It is the handling device of the semi-conductor wafer characterized by having structure which returns horizontally the migration last edge or just before that after moving in the direction left started, when separating.

[Claim 6] The handling device of the semi-conductor wafer characterized by having made the steep incline of the arm side grasping section into the vertical plane, and making the vertical plane concerned higher [than the thickness of a semi-conductor wafer] than the height of the tip side grasping section in the handling device of a semi-conductor wafer according to claim 1 or 3.

[Claim 7] The handling device of the semi-conductor wafer characterized by making the height of the arm side grasping section higher [than the thickness of a semi-conductor wafer] than the height of the tip side grasping section in the handling device of a semi-conductor wafer given in any 1 term among claims 1, 2, 4, and 5.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is applied to the handling device of the semi-conductor wafer (a wafer is only called hereafter) for manufacturing a reliable semiconductor device especially about the handling device using the robot hand (a hand is only called hereafter) which conveys circular sheet metal-like components, and relates to an effective technique.
[0002]
[Description of the Prior Art] The wafer in a semiconductor device production process is contained by the wafer carrier, and is having between each process conveyed conventionally.
[0003] Moreover, it is taken out by the handling device, the main doubling equipment said whose handling device is another equipment is passed, gap of the central point of a wafer is amended by this main doubling equipment, and the wafer contained by the wafer carrier is again set in each processor by the handling device.
[0004] Moreover, the wafer to which processing predetermined with each processor was performed is contained by the wafer carrier with the handling device.
[0005] Moreover, there is the following in the handling device of the conventional wafer.
[0006] (1) A rear-face contact mold and a belt contact and convey at the rear face of a wafer.
- The vacuum adsorption section sticks fast and conveys at the rear face of a wafer.
- Make a wafer slide and convey a susceptor top.
[0007] (2) Convey a periphery section perpendicular natural gravity support mold and a wafer in support of the upper part and the lower part of a wafer periphery in the condition of having stood perpendicularly.
- Convey in support of the lower part of a wafer periphery in the condition of having made the wafer inclining.
[0008] (3) Convey in support of the Bernoulli chuck mold and a wafer with fluid dynamic pressure.
[0009] (4) Put in and convey a fluid conveyance mold and a wafer with the flow of a liquid or a gas.
[0010] Moreover, the main doubling equipment of the conventional wafer supported the rear face of a wafer by susceptor, pushed the side face of a wafer from the side face of a wafer by two or more radii configuration frames and rotation rollers, a perpendicular pin, etc., let said susceptor top slide, and has doubled the core.
[0011] Moreover, a wafer (a diameter is about 150mm : 6 inches) is contained by the wafer carrier, and is having between each process usually conveyed.
[0012] A wafer carrier superimposes 25 wafers on 4.76mm (3/16 inch) regular intervals horizontally on the carrier for the diameter wafers of 6 inch common now based on mill specification (U.S.), and it is contained.
[0013] To a wafer with a diameter of about 150**0.2mm, the flute width of each stage support shelf is made by 153.42(**1.2) mm, and a 0.25mm inclination error is admitted to said wafer carrier (when supporting a cage hula part by chance, it will incline about 0.4mm of maxes). Moreover, the manufacture allowable tolerance (**0.15mm) of a pitch is added markedly, and the minimum opening when the opening between 0.6mm of wafer thickness then and a wafer supports the cage hula section further a minimum of 3.6mm an average of 3.9mm has become about 3.4mm.
[0014]
[Problem(s) to be Solved by the Invention] However, this invention person found out that there were the following troubles, as a result of examining said conventional technique.
[0015] The handling device of the conventional wafer does not have a means to double the core of a wafer.
[0016] For this reason, gap of delivery and a core must be amended to center position doubling equipment, and the wafer picked out from the wafer carrier with the handling device must be again set in each processor with a handling device.
[0017] Thus, since handling actuation is complicated, a wafer is polluted and dust is generated.
[0018] For this reason, a foreign matter mixes in a wafer. Consequently, there was a problem of being hard to manufacture a reliable semiconductor device.
[0019] Moreover, the member which the handling device of the conventional wafer contacts in order that a belt and the vacuum adsorption section may contact the rear face of the above-mentioned and a wafer pollutes a wafer rear face. Moreover, during handling, a wafer can be shaved and dust is generated.
[0020] For this reason, a foreign matter mixes in a wafer. Consequently, there was a problem of being hard to manufacture a reliable semiconductor device.
[0021] Moreover, a wafer carrier only supports a wafer and does not have the function to fix. For this reason, the condition that the wafer is contained by the wafer carrier is in the condition which each stage did not have complete set of, but was pulled out to the front or was pushed in to the back.
[0022] Thereby, the conventional handling device could not take out a wafer certainly, but might destroy the wafer.
[0023] Consequently, there was a problem that the yield of a semiconductor device fell.
[0024] The purpose of this invention is to offer the handling device of the wafer which can manufacture a reliable semiconductor device.
[0025] Other purposes of this invention are to offer the handling device of the wafer which can be improved in the yield of a semiconductor device.
[0026] Other purposes of this invention are to offer the technique which can prevent contamination of a wafer.
[0027] Other purposes of this invention are to offer the technique which can carry out the automatic centering of a semi-conductor wafer only by the hand.

[0028] Other purposes of this invention are to offer the technique which can arrange a wafer location in the direction of a hand center line before semi-conductor wafer grasping only by the hand.
[0029] Other purposes of this invention are to offer the technique which can grasp a semi-conductor wafer certainly.
[0030] As new along [said] this invention a description as the other purposes will become clear by description and the accompanying drawing of this specification.
[0031]
[Means for Solving the Problem] It will be as follows if the outline of a typical thing is briefly explained among invention indicated in this application.
[0032] The means of (1) of this invention has the central point in the location which projected the center position of the circle equivalent to a semi-conductor wafer periphery circle on the field parallel to a semi-conductor wafer side, when grasping actuation of a semi-conductor wafer is completed. The central point of the circle of the same diameter is mostly made into the aforementioned central point and homotopic. the center line on the flat surface passing through the central point can be used as the center line of a hand, and a semi-conductor wafer periphery circle can be fitted in and crowded -- It has a center section, respectively in the location of two points at which a circle and the center line of said hand concerned are crossed. It is the handling device of the semi-conductor wafer which made the predetermined range which met the circle concerned at the symmetry at the hand center line the semi-conductor wafer periphery section and the hand grasping section (it is also called a hand finger) which can be contacted through each center section. The point of the both ends of the arm side grasping section (arm side finger) of a hand the aperture angle made to the central point The point of the both ends of the cage hula section of a semi-conductor wafer makes it twice [more than] the aperture angle made to the central point of a semi-conductor wafer. Prepare a point of contact in the point of both ends, and three points of a center section at least, and the point of the both ends of the tip side grasping section (tip side finger) of a hand the aperture angle made to the central point Even if it carries out to beyond the aperture angle that the point of the both ends of the cage hula section of a semi-conductor wafer makes to the central point of a semi-conductor wafer, it prepares a point of contact in two points of both ends at least and the location of a cage hula is located in which location of the hand grasping section in case a semi-conductor wafer is grasped, it comes out and both hand grasping sections with the line which actually contacts a semi-conductor wafer first, respectively, which will exist and which connected each one point at least The include angle which the line which connected each point to the semi-conductor wafer central point makes is set up so that it may become beyond the friction angle of the hand grasping section and a semi-conductor wafer.
[0033] The means of (2) of this invention has the central point in the location which projected the center position of the circle equivalent to a semi-conductor wafer periphery circle on the field parallel to a semi-conductor wafer side, when grasping actuation of a semi-conductor wafer is completed. The central point of the circle of the same diameter is mostly made into the aforementioned central point and homotopic. the center line on the flat surface passing through the central point can be used as the center line of a hand, and a semi-conductor wafer periphery circle can be fitted in and crowded -- It has a center section, respectively in the location of two points at which a circle and the center line of said hand concerned are crossed. It is the handling device of the semi-conductor wafer which made the predetermined range which met the circle concerned at the symmetry at the hand center line the semi-conductor wafer periphery section and the hand grasping section which can be contacted through each center section. The point of the both ends of the arm side finger part of a hand the aperture angle made to the central point The point of the both ends of the cage hula section of a semi-conductor wafer makes it twice [more than] the aperture angle made to the central point of a semi-conductor wafer. Even the point which moved said beyond aperture angle of a cage hula towards the center section from each both ends is made into the hand grasping section. It carries out to four of the points which turned the point of contact in the center from both ends and there at least, and moved said beyond aperture angle of a cage hula. The point of the both ends of the cage hula section of a semi-conductor wafer uses the aperture angle which the point of the both ends of the tip side grasping section of a hand makes to the central point below as the aperture angle made to the central point of a semi-conductor wafer. Even if it makes a point of contact into two points of both ends, or one point of a center at least and the location of a cage hula is located in which location of a finger part in case a semi-conductor wafer is grasped, it comes out and both hand grasping sections with the line which actually contacts a semi-conductor wafer first, respectively, which will exist and which connected one point at least, respectively The include angle which the line which connected each point to the central point of a semi-conductor wafer makes is set up so that it may become beyond the friction angle of the hand grasping section and a semi-conductor wafer.
[0034] The means of (3) of this invention is set to the handling device of the above (1) or the wafer of (2). The inclination of the field of the entry part of the upper part which a wafer enters in the longitudinal-section configuration of the contact section of the arm side of a hand and the tip side grasping section is made into the steep slope side turned centering on the wafer at the time of grasping a wafer. An arm and tip side makes the interior which maintained the inclination until it reached the location near the diameter of the circular periphery of the flat base of a wafer, and went from it focusing on the hand the horizontally near conic gentle slope which went to the core from the height more nearly same than a hand flat surface.
[0035] The means of (4) of this invention is set to the handling device of the above (1) or the wafer of (2). The longitudinal-section configuration of the contact section of the arm side grasping section of a hand is made into a perpendicularly near internal surface in the upper part which is the wafer entry section. The part which went to the core from the height respectively more nearly same than a hand flat surface is made into a horizontally near conic gentle slope. Fix to a hand and this grasping section carries out the longitudinal-section configuration of the contact section of the grasping section by the side of a tip in the wall and gentle slope same in the entry section as the arm side grasping section. The contact section of this grasping section is made into an unit or two or more grasping sections, and is considered as a part for the moving part which lengthens or gets used toward the central point of a hand, or the arm side grasping section.
[0036] The means of (5) of this invention is set to the handling device of the above (1) or the wafer of (2). The longitudinal-section configuration of the contact section of the arm side grasping section of a hand is made into a perpendicularly near internal surface in the upper part which is the wafer entry section. The part which went to the core from the height respectively more nearly same than a hand flat surface is made into a horizontally near conic gentle slope. Fix to a hand and this grasping section part carries out the longitudinal-section configuration of the contact part of the grasping section by the side of a tip in the wall and gentle slope same in the entry section as the arm side grasping section. The direct front stirrup lengthened at the same time it considers as an unit or two or more grasping sections, and lengthens or leaves the contact section of this grasping section toward the core of a hand or the arm side grasping section stands up at a right angle to the direction lengthened immediately after. When separating, after moving in the direction left started, it has structure which returns horizontally the migration last edge or just before that.
[0037] In the handling device of the above (1) or the wafer of (3), the means of (6) of this invention makes a vertical plane the steep incline of the arm side grasping section, and makes the vertical plane concerned higher [than the thickness of a wafer] than the height of the tip side grasping section.

[0038] The means of (7) of this invention makes the height of the arm side grasping section higher [than the thickness of a wafer] than the height of the tip side grasping section in the handling device of any one wafer among the means of the above (1), (2), (4), and (5).
[0039]
[Function] Since the location of the central point of a wafer can be pinpointed according to physical relationship with the grasping section by grasping a wafer in three or more points of contact according to the means mentioned above, alignment of the core of a wafer is made, gap of delivery and a core is amended to center position doubling equipment, the wafer picked out from the wafer carrier is handled to it, and there is no need of setting in each processor. Moreover, since the man day of handling of a wafer becomes fewer, the foreign matters mixed at the time of handling of a wafer decrease in number. It enables this to manufacture a reliable semiconductor device.
[0040] Moreover, since a handling device does not contact the rear face of a wafer, a wafer cannot be shaved at the time of handling and dust is not generated. It enables this to manufacture a reliable semiconductor device.
[0041] Moreover, the part by the side of the support arm of the handling device of said grasping section boils that height makes it higher [than the thickness of said wafer] than other parts of said grasping section, a wafer is stuffed more into a wafer carrier, and since it can arrange, a wafer can be grasped certainly. Thereby, since a wafer is not destroyed at the time of handling, it becomes possible to improve the yield of a semiconductor device.
[0042]
[Example] Hereafter, the example of this invention is explained to a detail with reference to a drawing.
[0043] In addition, in the complete diagram for explaining an example, what has the same function attaches the same sign, and explanation of the repeat is omitted.
[0044] (Example 1) The top view in which the example 1 by this invention drawing drawing 1 near to which, and showing the outline configuration of the handling device of a formula semi-conductor wafer, and drawing 2 are the sectional views cut with the Y-Y line shown in drawing 1 .
[0045] In drawing 1 and drawing 2 , 1 is an arm for a semi-conductor wafer and 1A to support the cage hula of a wafer 1, and for 2 support a handling device.
[0046] Moreover, the arm side grasping section (arm side finger) prepared in the arm [for 3 to grasp a wafer 1] 2 side and 4 are the tip side grasping sections (tip side finger) which countered with the arm side grasping section 3 for grasping a wafer 1, and were prepared.
[0047] Moreover, a spring for 5 to return the tip side grasping section 4 to a position, the piston which carries out movable [of 6] with a spring 5, the rod with which 7 tells a motion of a piston 6 to the tip side grasping section 4, and 8 are suction openings for carrying out vacuum suction in order to carry out movable [of the piston 6].
[0048] The arm side grasping section 3 and the tip side grasping section 4 oppose mutually, and the handling device of the wafer 1 of this example 1 is formed in the arm 2, as shown in drawing 1 .
[0049] Said arm side grasping section 3 and the tip side grasping section 4 have three or more points of contact in contact with the periphery section of a wafer 1.
[0050] Said point of contact slides the tip side grasping section 4, in order to form said wafer 1 in the location which does not stand it still by friction with said point of contact, and to move said point of contact and to amend a gap of the location of a wafer 1. The detailed configuration is explained using drawing 3 .
[0051] Drawing 3 is the top view showing the condition that the hand was inserted in the rib S in a carrier to the wafer 1 supported by two points on the inferior surface of tongue.
[0052] The arm side grasping section 3 was equipped with points of contact A and B and B', and the location equips a core with an A point, and it equips the location of the aperture angle alpha almost equal to the aperture angle delta of cage hula 1A with B and B' point from there. By drawing 3 , minute angle rotation is counterclockwise carried out to the location of the arm side grasping section 3, and the location of cage hula 1A shows the condition that the location of both ends shifted for a while more nearly up than A and a B car point.
[0053] The tip side grasping section 4 is equipped with a point of contact C and C', is opened at the time of grasping, is arranged in the location of angle alpha, and is contained in the hand body in the state of drawing 3 .
[0054] Moreover, as shown in drawing 2 , gentle slopes 3b and 4b are established in the pars basilaris ossis occipitalis of the arm side grasping section 3 and the tip side grasping section 4 toward the center from the perpendicular walls 3a and 4a. And the arm side grasping section 3 is higher than the tip side grasping section 4 (more than the thickness of a wafer 1).
[0055] Namely, said arm side grasping section 3 and the tip side grasping section 4 When grasping actuation of a wafer 1 is completed, it has the central point O in the location which projected the center position of the circle equivalent to the periphery circle of a wafer 1 on the field parallel to a wafer side. The central point of the circle of the same diameter is mostly made into the aforementioned central point O and homotopic. the center line on the flat surface passing through the central point O can be used as the center line of a hand, and the periphery circle of a wafer 1 can be fitted in and crowded -- It has a center section, respectively in the location of two points at which a circle and the center line of said hand concerned are crossed. It is the hand grasping section in which the periphery section of a wafer 1 and contact are possible. [range / which met the hand center line in circle concerned through each center section at the symmetry / predetermined] B of the both ends of the arm side grasping section 3 of a hand and B' point aperture angle 2alpha made to the central point O The point of the both ends of cage hula 1A of a wafer 1 makes it twice [more than] the aperture angle (cage hula angle) delta made to the central point O of a wafer 1. For example, a point of contact is prepared in the point of both ends B and B', and three points of a center section A at least. The aperture angle alpha which the point C of the both ends of the tip side grasping section 3 of a hand and C' make to the central point O Even if it carries out to beyond the aperture angle delta that the point of the both ends of cage hula 1A of a wafer 1 makes to the central point O of a wafer 1, it prepares a point of contact in two points (for example, c and c' point) of both ends at least and the location of cage hula 1A is located in which location of the hand grasping section in case a wafer 1 is grasped, both arm side grasping sections 3 and the tip side grasping section 4 actually contact a wafer 1 first, respectively -- will come out and I will be -- at least -- each one point -- It is set up so that it may become beyond the friction angle of the arm side grasping section 3 and the tip side grasping section 4, and a wafer 1 about the angle lambda which the line (for example, line connected to a points and c points) which connected (for example, the A point), and the line which connected each point to the central point O of a wafer 1 make.
[0056] Next, grasping actuation of the handling device of the wafer of this example 1 is explained.
[0057] If the handling device (drawing near formula) of the wafer of this example 1 carries out movable [of the piston 6] by vacuum suction as shown in drawing 2 and drawing 3 , as shown in drawing 2 , it will consider the case where the tip side grasping section 4 is drawn in the right, the wafer 1 is turning eccentricity up as shown in drawing 3 , and cage hula 1A is in an above location.

[0058] At this time, the point of contact C of the tip side grasping section 4 contacts C point of a wafer 1, and contacts a wafer 1 to perpendicular wall 3a of the arm side grasping section 3. It becomes a points of a wafer, and the A point of the arm side grasping section 3 to contact the moment and the beginning. Consequently, the clip angle lambda arises, if this exceeds a friction angle, both or one side of A and C point will be slippery, eccentric correction will be carried out, either point of B' and C' point is contacted, and grasping is completed. And it separates from the rib S of a carrier.
[0059] Moreover, when the location of cage hula 1A is carrying out eccentricity similarly in C and C' location, it inserts in C' and a B point and angle lambda is produced. About the correspondence examination to all cage hula locations, it mentions later.
[0060] Thus, if vacuum suction of the grasping actuation of the handling device of this example 1 is carried out from the suction opening 8, the spring force of a spring 5 will be resisted, a piston 6 will move, and it will slide the tip side grasping section 4 through a rod 7. This grasps a wafer 1 in the arm side grasping section 3 and the tip side grasping section 4. Moreover, if vacuum suction is canceled, it will return to the condition of a basis with a spring 5.
[0061] Here, the principle of an automatic eccentricity correction operation of the handling device of the semi-conductor wafer by this invention is explained using this example 1.
[0062] Stability and in order to grasp certainly, even if the relative position of a hand differs from the wafer 1 before grasping in the wafer 1, as for after grasping, it is desirable for a wafer 1 to be in the position of a hand. It is required for it in grasping actuation to have the eccentric correction function moved to the core of a wafer 1.
[0063] Drawing 4 is drawing for explaining the principle to which the force is applied to A of a radii part, and C point for a circular plate like a wafer 1, and a core is moved, and is the case where two force of tending toward two points, A of the periphery radii section of a wafer 1 and C point, in the central point O of a wafer 1 acts. Drawing 5 is drawing showing the time of one of the point of application of the force starting the cage hula 1A section.
[0064] In drawing 4 and drawing 5 , it is decomposed into component of a force Fr (several 1) and Ft (several 2), and frictional force muF (mu is coefficient of friction) which opposes component of a force Ft generates the force F of each point. If this resultant force Fe becomes like several 3 and several 4 conditions are fulfilled, the relative displacement which slides with the part which contacts a wafer 1 at both A, a B point, or one side or which is depended for rolling arises, as shown in the (a) Fig. of drawing 5 , it will move in the direction of an arrow head automatically, and eccentric correction of the central point O will be carried out.
[0065] When the force in which F goes to the central point O from a point of contact A and a point of contact C, and lambda consider as the clip angle (**OAB, **OBA) made in a point of contact A, a point of contact C, and the central point O, component of a force Ft and Fr is expressed with the 1 and 2 numbers of degree types.
[0066]
[Equation 1] Fr=F/coslambda [0067]
[Equation 2] The Ft=tanlambda resultant force Fe is component of a force Ft and resultant force of frictional force muF, and is expressed with the-three number of degree types, and several 4.
[0068]
[Equation 3] Fe=2(Ft-muF) coslambda=2(sinlambda-mucoslambda) F> 0 [0069]
[Equation 4] Only in lambda', Force F inclines like F' here by the case where the (a) Fig. of mu<tan lambda drawing 5 and the (b) Fig. require one point of application for a cage hula location. Therefore, the case where force Ft' occurs to the correction direction and hard flow arises like C point of the (b) Fig. of drawing 5 . Therefore, this point does not move but only an A point produces a correction operation. Fr at that time and Ft' are expressed with the-five number of degree types, and several 6.
[0070]
[Equation 5] Fr=F'/cos (lambda**lambda') [0071]
[Equation 6] Ft'=tan (lambda**lambda') drawing 6 is drawing for explaining arrangement of the limitation that said arm side grasping section 3 and the tip side grasping section 4 maintain an eccentric correction function on the periphery of a wafer 1. (a) When a Fig., the (b) Fig., and the (c) Fig. have cage hula 1A in the arm side grasping section 3, respectively, the Fig. (a'), the Fig. (b'), and the Fig. (c') show the case where cage hula 1A is in the tip side grasping section 4, respectively.
[0072] (a) Drawing is the case where a cage hula edge starts near the A point of the center section of the arm side grasping section 3, and the B point of an edge. Supposing the wafer is carrying out eccentricity to the upper part as mentioned above, a B point will not contact but will generate the clip angle lambda on which the central point O and the line of a wafer 1 make the line which connected A and C both points, and each point. (a') It faces across a Fig. at B and C' both points similarly, and it generates angle lambda.
[0073] The aforementioned relation is materialized unless the relative position on the geometry of A, B, and three C is changed. (b) Drawing and a Fig. (b') are the arrangement only beta rotated [arrangement] the (a) Fig. counterclockwise.
[0074] Next, the correction accompanying change of the eccentric correction working angle at the time of the wafer eccentricity of the handling device of the semi-conductor wafer by this invention is explained.
[0075] Drawing 7 and drawing 8 are drawings having exaggerated and shown the eccentricity of a wafer 1, (a) of drawing 7 and a Fig. (a') are equivalent to the Fig. (a') of drawing 6 , and the (a) Fig., and drawing 8 is equivalent to (c) of drawing 6 .
[0076] Since the aperture angle alpha of the arm side grasping section 3 and the tip side grasping section 4 does not act effectively with the eccentricity of a wafer 1 so that drawing 7 and drawing 8 may show, it is necessary to have allowances in the aperture angle alpha that much beforehand. The relation between the clip angle lambda and a friction angle will become like the-seven number of degree types, if epsilon is made into eccentric angles of lead.
[0077]
[Equation 7] lambda=alpha-epsilon -- incidentally, by the case where the diameter of a wafer 1 is 6 inches, when the eccentricity e of the count top wafer 1 is 3mm, component of a force Ft and frictional force muF become equal -- it inserts and angle lambda is about 1.7 degrees in the case of 8 inches about 2.3 degrees.
[0078] Next, thin shape-ization of the wafer eccentricity correction approach and a hand finger (the arm side grasping section 3 and tip side grasping section 4) by this invention is explained.
[0079] Drawing and drawing 10 supposing the process subsided into the posture stabilized according to orthodontic force in the steep slope by drawing 9 are what exaggerated eccentricity and showed all drawings assumed about the severest cage hula location in which eccentric correction is possible, and are in the condition in which was attached (a) of drawing 6 , and in the Fig. (a'), and the wafer 1 carried out eccentricity to the upper right or the upper left.
[0080] If one point of the radii section of a wafer periphery surely starts a steep slope side and a gentle slope moreover has x points of the direction of 180 degrees there in the radii section from there when both the grasping section of the arm side grasping section 3 and the tip side grasping section 4 is prepared in the range exceeding the aperture angle delta of cage hula 1A of a wafer 1, it will support by these two points. (a-1) Appear in b points in c points and a Fig. (a' - 1), and c points appear in the high location on a steep slope side by a diagram in a points and a Fig. (a-2) (a' - 2). (a-1), (a-2), and in a Fig. (a' - 2), there are x points on a gentle slope. (a' - 1) In a Fig.,

it separates from the arm side grasping section 3 and the tip side grasping section 4, and c' and b' point turn into a supporting point.
[0081] Drawing 11 is drawing for explaining the principle in which the self-weight of a wafer 1 generates orthodontic force in the aforementioned condition, the (a) Fig. is drawing of longitudinal section, and the (b) Fig. is a top view of the (a) Fig. The case in a points of a Fig. (a-1) of drawing 11 is chosen and shown as a representative. a and the force generated in x points are shown in the (a) Fig. in early stages, and the force at the time of orthodontic force generating is shown in the (b) Fig.
[0082] The wafer gravity W shown in the (a) Fig. of drawing 11 is expressed like several 8. Q' like several 9 and several 11, Q and R, and R' occur according to this force. Among those, the force F of R and R' generating the drag force to the force of sliding on a tilt angle and getting down from it, and sliding and getting down is expressed with several 11 and 12. Then, the steep slope angle phi becomes the value of F shown in 90 degrees several 13 if the gradual slope angle psi is close to 0 degree soon. if a points are slippery and get down by Force F according to this force -- drawing 11 -- setting -- a Fig. (a-1) -- c points -- C point -- a Fig. (a-2) -- a points -- an A point -- a Fig. (a' - 1) -- c' point -- C' -- b points carry out **** contact in ** by a diagram (a' - 2) at a point at a B point. (a' - 1) In a Fig., c' and the force of b' touching, and wafer gravity being distributed to three points by several 8, sliding, and getting down are increased, but detailed formula explanation is omitted. Before the force which the force of the (b) Fig. of drawing 11 generates and is shown in the several 14 [same] as several 3 occurring and reaching the stable state of the (b) Fig. of drawing 9 at the moment, an eccentric correction operation works.
[0083] Drawing 12 shows the example of arrangement of the hand finger (the arm side grasping section 3 and tip side grasping section 4) which used this principle, the (a) Fig. is a top view and the (b) Fig. is a sectional view. This drawing 12 shows repeatedly the case where a cage hula location is in an arm and tip side.
[0084]
[Equation 8] 2+W [W=W/]/2 [0085]
[Equation 9] Q=(W/2) sinphi Q'=(W/2) sinpsi [0086]
[Equation 10] R=(W/2) cosphi R'=(W/2) cospsi [0087]
[Equation 11] F=(Q-muR) sinphi-(Q'+muR') sinpsi [0088]
[Equation 12] = W/2{(sinphi-mucosphi) sinphi-(sinpsi-mucospsi) sinpsi} [0089]
[Equation 13] F=(W/2) (1-mu) > 0 [0090]
[Equation 14] F0=2(Ft-mu Fr) =2F(sinlambda-mucoslambda) coslambda(sinlambda-mucoslambda) > The sectional view and drawing 15 which were cut with the Y-Y line which shows the top view showing the outline configuration of the handling device of the boom-hoisting type semi-conductor wafer of the example 2 according [0 and tan lambda>mu (example 2) drawing 13] to this invention and drawing 14 to drawing 13 are an important section sectional view for explaining boom-hoisting actuation of the tip side grasping section of a boom-hoisting-type handling device.
[0091] In drawing 13 , drawing 14 , and drawing 15 , the piece of connection by which 9 connects the tip side grasping section 4 with a rod 7, the rotation shaft with which 10 consists of Hindu etc., and 11 are inclined plane members.
[0092] The arm side grasping section 3 and the tip side grasping section 4 oppose mutually, and the handling device of the wafer 1 of this example 2 is formed in the arm 2, as shown in drawing 13 and drawing 14 .
[0093] Moreover, the arm side grasping section 3 and the tip side grasping section 4 have three or more points of contact in contact with the periphery section of a wafer 1.
[0094] Moreover, said point of contact rises and falls, and in order to form said wafer 1 in the location which does not stand it still by friction with said point of contact, and to move said point of contact and to amend a gap of the location of a wafer, it is making the tip side grasping section 4 contact and desert to a wafer 1.
[0095] Moreover, the arm side grasping section 3 is higher [than the thickness of a wafer 1] than the tip side grasping section 4.
[0096] If vacuum suction of the grasping actuation of the handling device of the boom-hoisting type semi-conductor wafer of this example 2 is carried out from the suction opening 8, the spring force of a spring 5 will be resisted, a piston 6 will move, and the tip side grasping section 4 will move through a rod 7 and the piece 9 of connection. Since the inclined plane member 11 of a hand is being fixed, the tip side grasping section 4 rotates centering on the rotation shaft 10, as shown in (a) (b) Fig. of drawing 15 , it rises and falls from the condition of a Fig., and as further shown in the (c) Fig., to a wafer 1, it approaches and it contacts. This grasps a wafer 1 in the arm side grasping section 3 and the tip side grasping section 4. Moreover, if vacuum suction is canceled, with a spring 5, it is shown in the (b) Fig. from the condition of (c) of drawing 15 , and it will come to carry out a condition and will return to the condition of the (a) Fig. further.
[0097] (Example 3) The top view showing the outline configuration of the handling device of the gravity equation semi-conductor wafer of the example 3 according [drawing 16] to this invention and drawing 17 are the sectional views cut with the Y-Y line shown in drawing 16 .
[0098] In drawing 16 and drawing 17 , the gradual slope section by which 20 was prepared in the arm side grasping section 3 and the tip side grasping section 4, and 21 are the steep slope sections prepared in the arm side grasping section 3 and the tip side grasping section 4.
[0099] The arm side grasping section 3 and the tip side grasping section 4 oppose mutually, and the handling device of the wafer 1 of this example 3 is formed in the arm 2, as shown in drawing 16 and drawing 17 .
[0100] Moreover, the arm side grasping section 3 and the tip side grasping section 4 have three or more points of contact in contact with the periphery section of a wafer 1.
[0101] Moreover, said point of contact is prepared in the location where said wafer 1 does not stand it still by friction with said point of contact.
[0102] Moreover, the arm side grasping section 3 is higher than the thickness of a wafer 1 more highly than the tip side grasping section 4.
[0103] Moreover, the gradual slope section 20 and the steep slope section 21 are formed in the arm side grasping section 3 and the tip side grasping section 4.
[0104] Grasping actuation of the handling device of the gravity equation semi-conductor wafer of this example 3 inserts a handling device in the wafer carrier which contained the wafer 1 first, and pushes in and arranges a wafer 1 with a wafer carrier in the part to which the arm side grasping section 3 became high at this time.
[0105] Next, a wafer 1 is lifted. At this time, the wafer 1 touches the arm side grasping section 3 and the tip side grasping section 4 only in the periphery section. And a wafer 1 slides on the steep slope section 21 top, and stands it still in the place whose wafer periphery corresponded with the boundary of the steep slope section 21 and the gradual slope section 20. Thereby, a wafer can be grasped, without contacting the rear face of a wafer 1.
[0106] As mentioned above, since the arm side grasping section 3 and the tip side grasping section 4 are being fixed to the arm 2, the location of the center position O of the wafer 1 concerned can be pinpointed according to the physical relationship of the arm side

grasping section 3 and the tip side grasping section 4, and the grasped wafer 1. That is, center position doubling of a wafer 1 is made.
[0107] Thereby, the handling device of this example 3 can acquire the same effectiveness as examples 1 and 2.
[0108] Moreover, since the arm side grasping section 3 and the tip side grasping section 4 do not carry out movable [of the handling device of this example 3], it is easy structure. For this reason, since the reinforcement for supporting a wafer 1 should just have the thickness of a handling device, the handling device of this example 3 can make thickness thin. Consequently, it is possible to insert into the clearance between the wafers contained by the wafer carrier.
[0109] Here, the correspondence to a dimension limit of the hand finger at the time of carrier correspondence is explained.
[0110] First, it is receipts and payments from a carrier that severe conditions are imposed dimensionally first. Drawing 18 is drawing showing the outline configuration of the carrier for wafers of the diameter of 6 inch based on the mill specification (U.S.) of a wafer carrier, and the (a) Fig. is an enlarged drawing of the part into which the front view and the (b) Fig. surrounded the cross-section side cut with the Y-Y line of a Fig., and (a) (c) Fig. by O mark.
[0111] As shown in drawing 18 , horizontally, at the time of **, a wafer 1 superimposes 25 datum planes of a carrier 30 on regular intervals with a nominal size of 3/16 inch (4.76mm) horizontally, and they are contained.
[0112] Both the peripheral edges of the diameter which passes along the center of gravity O of a wafer 1 on the shallow inclination side of about 4.6 degrees appear, and the marked wafer support point is supported by both-ends T2 point, as shown in drawing 18 . It is made by the diameter of 150**0.2mm, and a 0.25mm inclination error is admitted (when supporting a cage hula part by chance, it will incline about 0.4mm of maxes).
[0113] Moreover, the manufacture allowable tolerance (**0.15mm) of a pitch is added markedly, and the minimum opening when the opening between 0.6mm of wafer thickness then and a wafer 1 supports the cage hula section further a minimum of 3.6mm an average of 3.9mm is set to an average of 3.4mm.
[0114] Moreover, although a hand finger passes through the gap on this top face of a beam in the case of receipts and payments of the bottom wafer 1 since beam 30a which meets a bottom wafer, and connects the right-and-left both-sides plate of a carrier cage as shown in drawing passes near the basic surface of a carrier, this opening distance is estimated at an average of 3.75mm and a minimum of 3.3mm.
[0115] The thickness (height) allowed the wafer base material (hand) which passes through 3.3mm **** space covering a wafer diameter at 3.4mm of least intervals of said wafer interstage and the lowest edge needs to constitute vertical path clearance in the limit size of the shape of sheet metal of there there 2mm as what is secured 0.5mm, respectively. 4mm will become limit size if the same estimate is performed about a 8 inch wafer.
[0116] As mentioned above, although invention made by the artificer was concretely explained based on the example, it cannot be overemphasized that it can change variously in the range which this invention is not limited to said example and does not deviate from the summary.
[0117]
[Effect of the Invention] It will be as follows if the effectiveness acquired by the typical thing among invention indicated in this application is explained briefly.
(1) Since the rear face of a wafer is not contacted, contamination can be prevented.
(2) The automatic centering of a wafer can be performed only by the hand.
(3) A wafer location can be arranged in the direction of a hand center line before wafer grasping only by the hand.
(4) A wafer can be grasped certainly.
(5) The above (1) thru/or (4) enable it to manufacture a reliable semiconductor device, and it becomes possible to raise the yield of a semiconductor device.

[Translation done.]

DESCRIPTION OF DRAWINGS

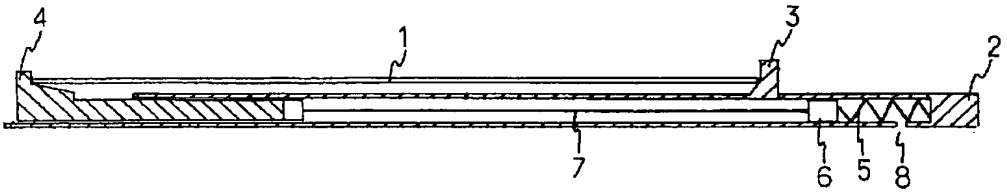
[Brief Description of the Drawings]
[Drawing 1] The top view in which the example 1 by this invention drawing near to which, and showing the outline configuration of the handling device of a formula semi-conductor wafer,
[Drawing 2] The sectional view cut with the Y-Y line shown in drawing 1 ,
[Drawing 3] The top view showing the condition that the hand was inserted in the rib in the carrier of this example 1 to the wafer supported by two points on the inferior surface of tongue,
[Drawing 4] Drawing for explaining the principle to which the force is applied to A of a radii part, and C point for a circular plate like the wafer by this invention, and a core is moved,
[Drawing 5] Drawing showing the time of one of the point-of-application points of the force by this invention starting the cage hula section,
[Drawing 6] Drawing for explaining arrangement of the limitation that the arm side grasping section by this invention and the tip side grasping section maintain an eccentric correction function on the periphery of a wafer,
[Drawing 7] Drawing having exaggerated and shown the eccentricity of a wafer,
[Drawing 8] Drawing having exaggerated and shown the eccentricity of a wafer,
[Drawing 9] Drawing supposing the process subsided into the posture stabilized according to orthodontic force,
[Drawing 10] Drawing having exaggerated and shown the assumed eccentricity about the severest cage hula location in which eccentric correction is possible,
[Drawing 11] Drawing for explaining the principle in which the self-weight of the wafer by this invention generates orthodontic force,
[Drawing 12] Drawing having shown the example of arrangement of the hand finger (arm side grasping section and tip side grasping section) by this invention,
[Drawing 13] The top view showing the outline configuration of handling device ** of the boom-hoisting type semi-conductor wafer of the example 2 by this invention,
[Drawing 14] The sectional view cut with the Y-Y line shown in drawing 14 ,
[Drawing 15] The important section sectional view for explaining boom-hoisting actuation of the tip side grasping section of the handling device of the boom-hoisting type semi-conductor wafer of this example 2,
[Drawing 16] The top view showing the outline configuration of the handling device of the gravity equation semi-conductor wafer of the example 3 by this invention,
[Drawing 17] The sectional view cut with the Y-Y line shown in drawing 17 ,
[Drawing 18] Drawing showing the outline configuration of the carrier for wafers of the diameter of 6 inch based on the mill specification (U.S.) of the wafer carrier concerning this invention.
[Description of Notations]
1 [-- Arm side grasping section (arm side finger),] -- A wafer, 1A -- A cage hula, 2 -- An arm, 3 4 [-- Suction opening, 9 / -- The piece of connection, 10 / -- A rotation shaft, 11 / -- An inclined plane member, 20 / -- The gradual slope section, 21 / -- The steep slope section, A, B, C / -- A point of contact, F / -- The force, O / -- The central point, mu / -- Coefficient of friction, lambda / -- A clip angle, delta / -- Cage hula angle.] -- The tip side grasping section (tip side finger), 5 -- A spring, 7 -- A rod, 8

[Translation done.]

DRAWINGS

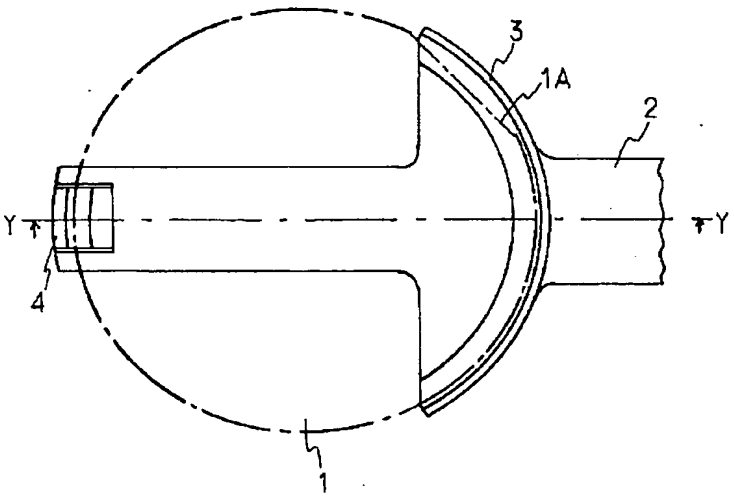
[Drawing 2]

図2



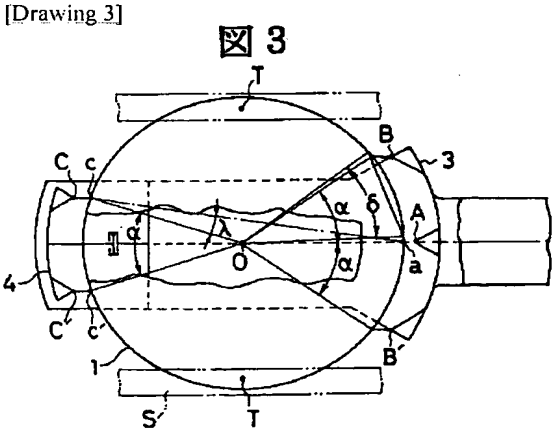
[Drawing 1]

図1



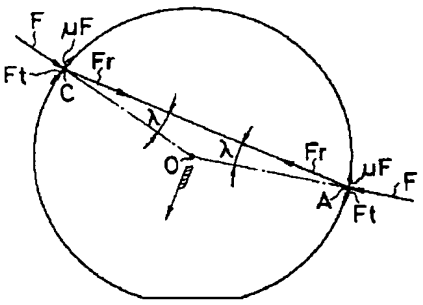
[Drawing 3]

図3



[Drawing 4]

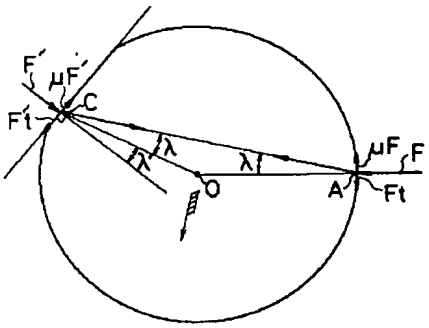
図 4



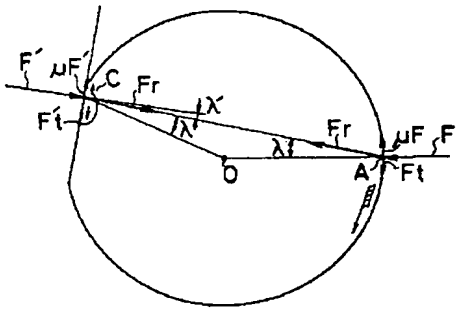
[Drawing 5]

図 5

(a)

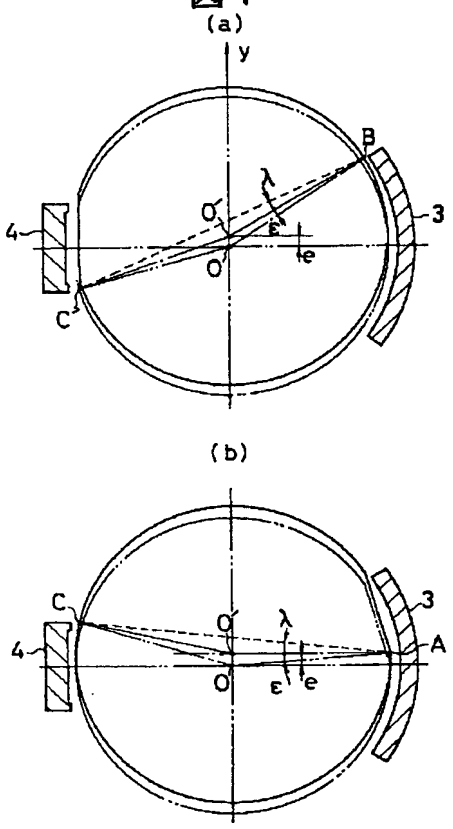


(b)



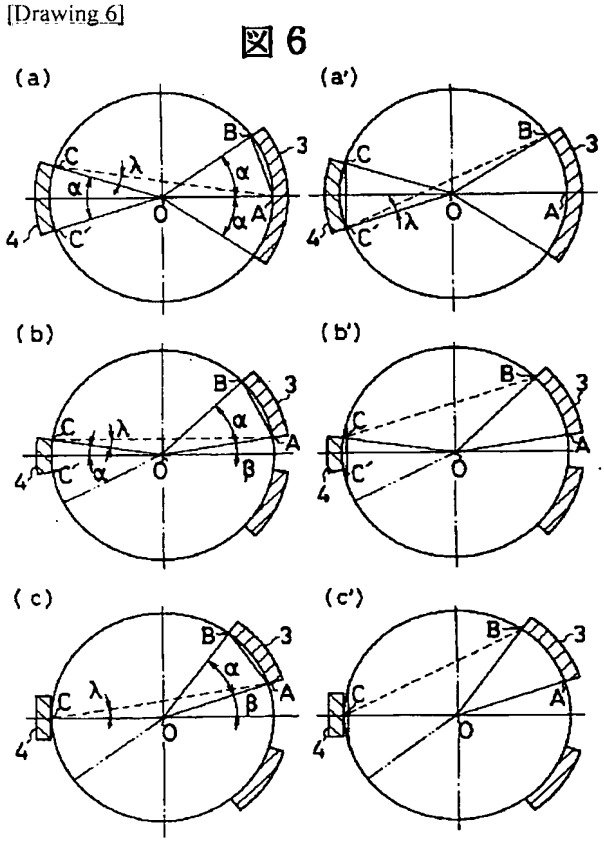
[Drawing 7]

図 7



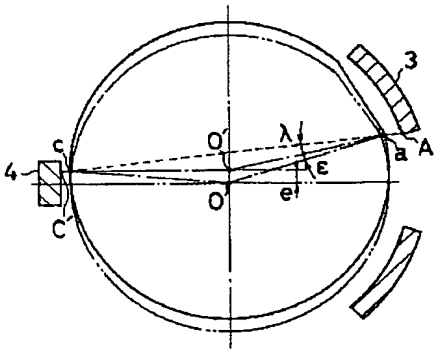
[Drawing 6]

図 6



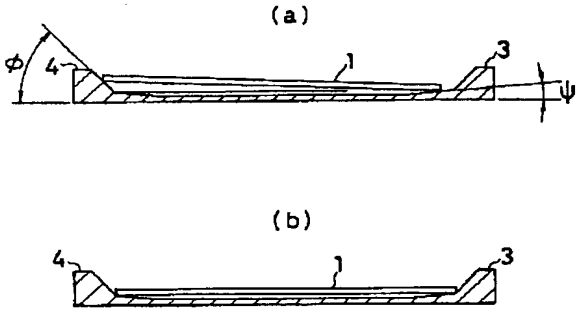
[Drawing 8]

図 8



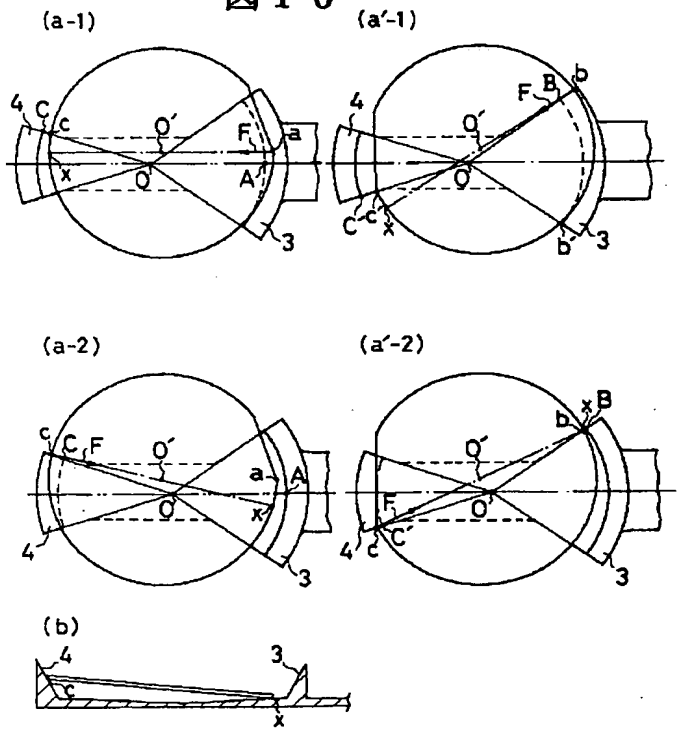
[Drawing 9]

図 9



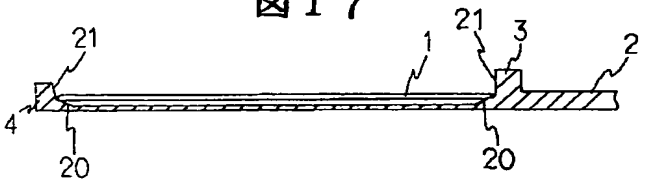
[Drawing 10]

図 1 0



[Drawing 17]

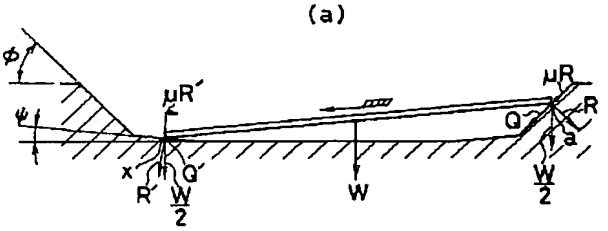
図 1 7



[Drawing 11]

図11

(a)



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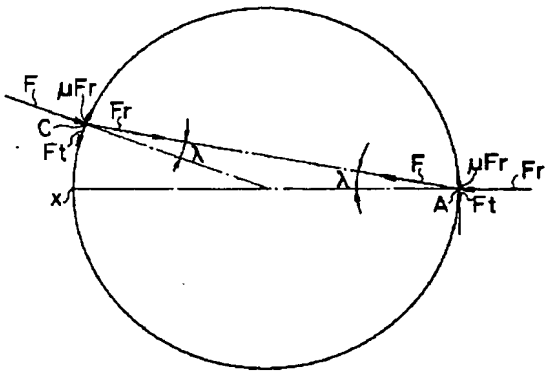
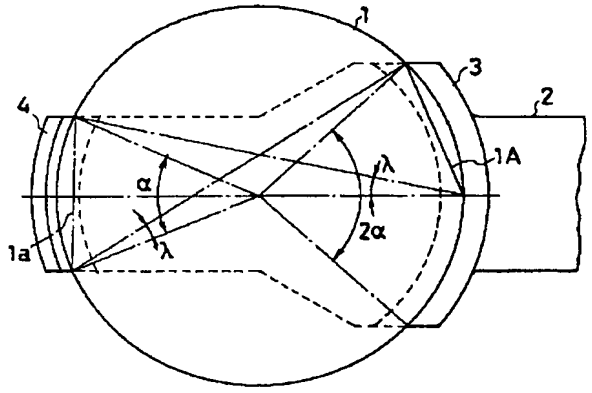


[Drawing 12]

図12

(a)



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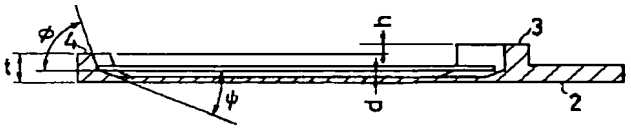
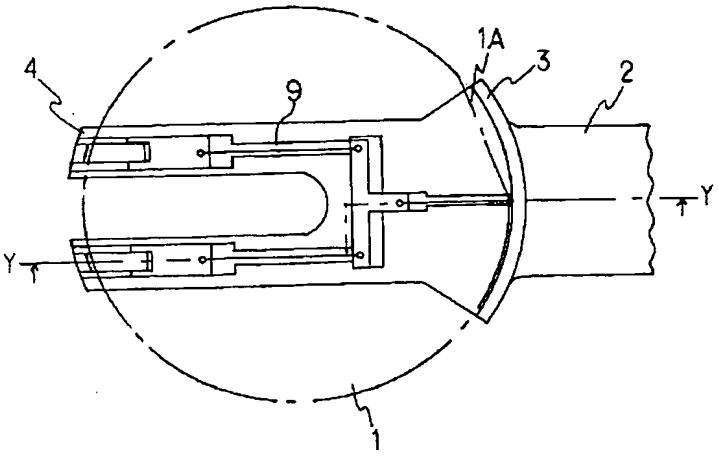


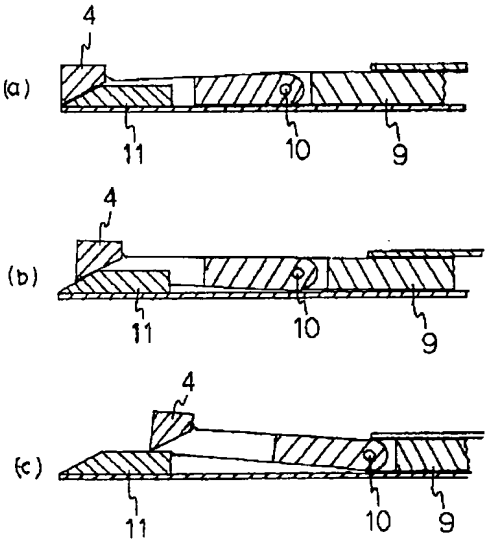
[Drawing 13]

図１３



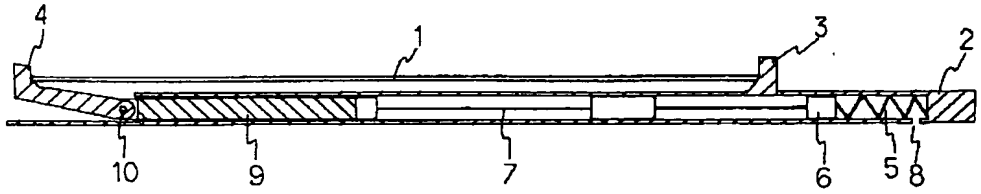
[Drawing 15]

図１５



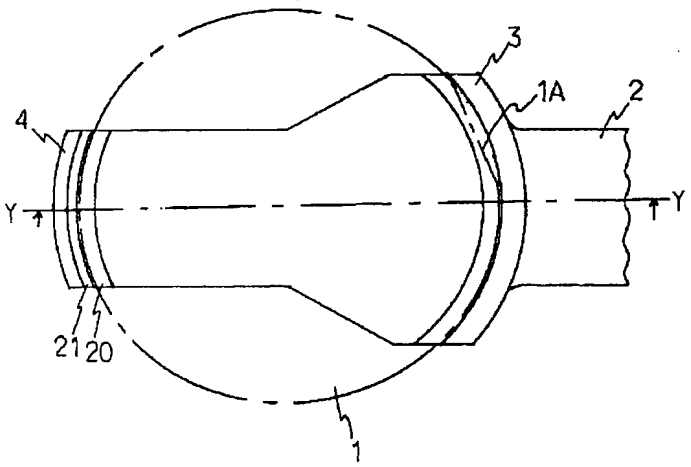
[Drawing 14]

図１４



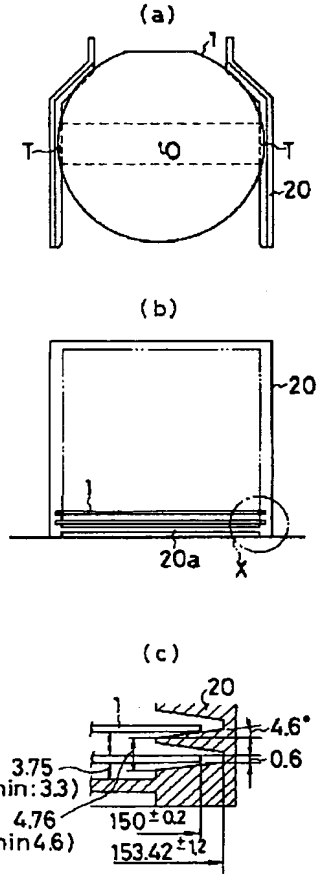
[Drawing 16]

図16



[Drawing 18]

図18



[Translation done.]

CORRECTION OR AMENDMENT

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[Application number] Japanese Patent Application No. 5-161545
[The 7th edition of International Patent Classification]

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B25J 15/08

[FI]

H01L 21/68 S
A
B25J 15/08 Z

[Procedure revision]
[Filing Date] June 13, Heisei 12 (2000. 6.13)
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[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] The handling device of the semi-conductor wafer characterized by having two or more grasping sections with the gentle slope used as the steep slope side for grasping the periphery section of a semi-conductor wafer, and the slideway for the periphery section of the semi-conductor wafer laid by carrying out eccentricity imitating, and reaching to said steep slope side, and the core of a semi-conductor wafer being grasped by grasping actuation of two or more of said grasping sections in a predetermined location.
[Claim 2] When grasping actuation of a semi-conductor wafer is completed, it has the central point in the location which projected the center position of the circle equivalent to a semi-conductor wafer periphery circle on the field parallel to a semi-conductor wafer side. The central point of the circle of the same diameter is mostly made into the aforementioned central point and homotopic. the center line on the flat surface passing through the central point can be used as the center line of a hand, and a semi-conductor wafer periphery circle can be fitted in and crowded -- It has a center section, respectively in the location of two points at which a circle and the center line of said hand concerned are crossed. It is the handling device of the semi-conductor wafer which made the predetermined range which met the circle concerned at the symmetry at the hand center line the semi-conductor wafer periphery section and the hand grasping section which can be contacted through each center section. The point of the both ends of the cage hula section of a semi-conductor wafer uses the aperture angle which the point of the both ends of the arm side grasping section of a hand makes to the central point as twice [more than] the aperture angle made to the central point of a semi-conductor wafer. Prepare a point of contact in the point of both ends, and three points of a center section at least, and the point of the both ends of the tip side grasping section of a hand the aperture angle made to the central point Even if it carries out to beyond the aperture angle that the point of the both ends of the cage hula section of a semi-conductor wafer makes to the central point of a semi-conductor wafer, it prepares a point of contact in two points of both ends at least and the location of a cage hula is located in which location of the hand grasping section in case a semi-conductor wafer is grasped, it comes out and both hand grasping sections with the line which actually contacts a semi-conductor wafer first, respectively, which will exist and which connected each one point at least The handling device of the semi-conductor wafer characterized by setting up the include angle which the line which connected each point to the semi-conductor wafer central point makes so that it may become beyond the friction angle of the hand grasping section and a semi-conductor wafer.
[Claim 3] When grasping actuation of a semi-conductor wafer is completed, it has the central point in the location which projected the center position of the circle equivalent to a semi-conductor wafer periphery circle on the field parallel to a semi-conductor wafer side. The central point of the circle of the same diameter is mostly made into the aforementioned central point and homotopic. the center line on the flat surface passing through the central point can be used as the center line of a hand, and a semi-conductor wafer periphery circle can be fitted in and crowded -- It has a center section, respectively in the location of two points at which a circle and the center line of said hand concerned are crossed. It is the handling device of the semi-conductor wafer which made the predetermined range which met the circle concerned at the symmetry at the hand center line the semi-conductor wafer periphery section and the hand grasping section which can be contacted through each center section. The point of the both ends of the arm side finger part of a hand the aperture angle made to the central point The point of the both ends of the cage hula section of a semi-conductor wafer makes it

twice [more than] the aperture angle made to the central point of a semi-conductor wafer. Even the point which moved said beyond aperture angle of a cage hula towards the center section from each both ends is made into the hand grasping section. It carries out to four of the points which turned the point of contact in the center from both ends and there at least, and moved said beyond aperture angle of a cage hula. The point of the both ends of the cage hula section of a semi-conductor wafer uses the aperture angle which the point of the both ends of the tip side grasping section of a hand makes to the central point below as the aperture angle made to the central point of a semi-conductor wafer. Even if it makes a point of contact into two points of both ends, or one point of a center at least and the location of a cage hula is located in which location of a finger part in case a semi-conductor wafer is grasped, it comes out and both hand grasping sections with the line which actually contacts a semi-conductor wafer first, respectively, which will exist and which connected one point at least, respectively The handling device of the semi-conductor wafer characterized by setting up the include angle which the line which connected each point to the central point of a semi-conductor wafer makes so that it may become beyond the friction angle of the hand grasping section and a semi-conductor wafer.

[Claim 4] In the handling device of a semi-conductor wafer according to claim 2 or 3 The inclination of the field of the entry part of the upper part which a semi-conductor wafer enters in the longitudinal-section configuration of the contact section of the arm side of a hand and the tip side grasping section is made into the steep slope side turned centering on the semi-conductor wafer at the time of grasping a semi-conductor wafer. The interior which maintained the inclination until it reached the location near the diameter of the circular periphery of the flat base of a semi-conductor wafer, and went from it focusing on the hand The handling device of the semi-conductor wafer characterized by making an arm and tip side into the horizontally near conic gentle slope which went to the core from the height more nearly same than a hand flat surface.

[Claim 5] In the handling device of a semi-conductor wafer according to claim 2 or 3 The longitudinal-section configuration of the contact section of the arm side grasping section of a hand is made into a perpendicularly near internal surface in the upper part which is the semi-conductor wafer entry section. The part which went to the core from the height respectively more nearly same than a hand flat surface is made into a horizontally near conic gentle slope. Fix to a hand and this arm side grasping section carries out the longitudinal-section configuration of the contact section of the tip side grasping section in the wall and gentle slope same in the entry section as the arm side grasping section. The handling device of the semi-conductor wafer which makes the contact section of this tip side grasping section an unit or two or more grasping sections, and is characterized by considering as a part for the moving part lengthened or left toward the central point of a hand, or the arm side grasping section.

[Claim 6] In the handling device of a semi-conductor wafer according to claim 2 or 3 The longitudinal-section configuration of the contact section of the arm side grasping section of a hand is made into a perpendicularly near internal surface in the upper part which is the semi-conductor wafer entry section. The part which went to the core from the height respectively more nearly same than a hand flat surface is made into a horizontally near conic gentle slope. Fix to a hand and this arm side grasping section carries out the longitudinal-section configuration of the contact part of the tip side grasping section in the wall and gentle slope same in the entry section as the arm side grasping section. It stands up at a right angle to the direction lengthened immediately after just before lengthening at the same time it considers as an unit or two or more grasping sections, and lengthens or leaves the contact section of this grasping section toward the core of a hand, or the arm side grasping section. It is the handling device of the semi-conductor wafer characterized by having structure which returns horizontally the migration last edge or just before that after moving in the direction left started, when separating.

[Claim 7] The handling device of the semi-conductor wafer characterized by having made the steep incline of the arm side grasping section into the vertical plane, and making the vertical plane concerned higher than the thickness of the Sayori Taka semi-conductor wafer of the tip side grasping section in the handling device of a semi-conductor wafer given in any 1 term claim 1 thru/or among 6.

[Claim 8] The handling device of the semi-conductor wafer characterized by making the height of the arm side grasping section higher than the thickness of the Sayori Taka semi-conductor wafer of the tip side grasping section in the handling device of a semi-conductor wafer given in any 1 term claim 1 thru/or among 6.

[Procedure amendment 2]

[Document to be Amended] DRAWINGS

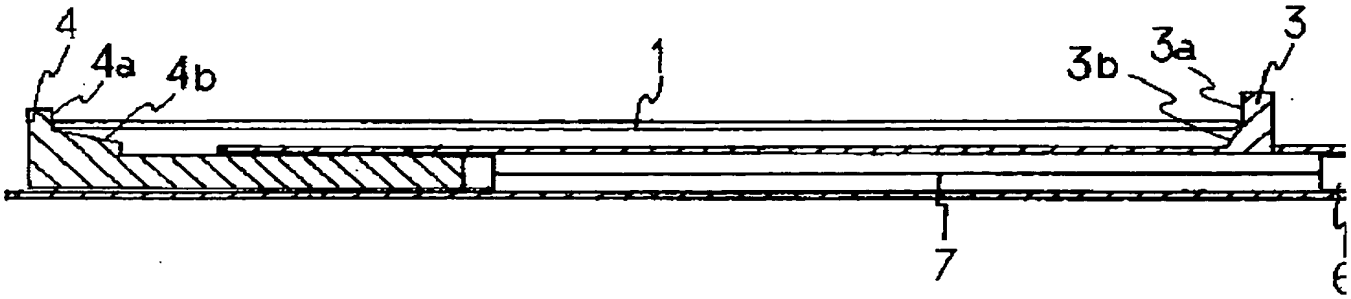
[Item(s) to be Amended] drawing 2

[Method of Amendment] Modification

[Proposed Amendment]

[Drawing 2]

図2



[Translation done.]

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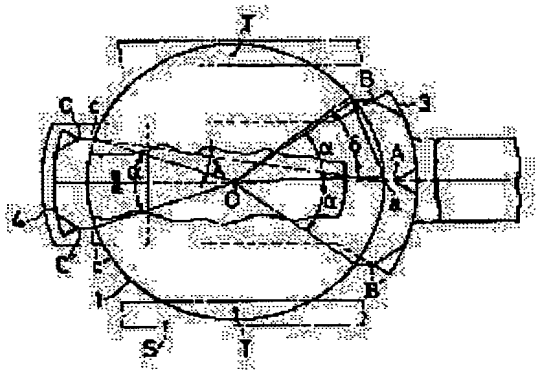
(54) HANDLING UNIT FOR SEMICONDUCTOR WAFER

(57)Abstract:
PURPOSE: To manufacture a semiconductor device with higher reliability by setting the positional relationship of holding section so that the center position of a wafer is specified to prevent the contamination of the rear side of the wafer.
CONSTITUTION: The opening angle 2α that the points B, B' at both ends of an arm side holding section make with respect to the center point O is set more than twice the opening angle (orientation flat angle) that the points at both ends of the orientation flat make with respect to the center point O of the wafer 1, and the contacting points are provided at the three points of both ends B, B' and the center point A. Moreover, the opening angle α that the points C, C' at both ends of the top side holding section make with respect to center point O is set more than the orientation flat angle δ, the contacting points are provided at the two points C, C' of both ends. The angle λbetween the line drawn between the point A on each section where both arm side holding sections 3 and the top side holding section 4 contact with the wafer 1 at the first time even if the orifra is in any position on the hand holding section (the line between a and c) and the center point O of the wafer 1 drawn between each point is set so that it is more than the friction angle between the arm side holding section 3 and top side holding section 4 and the wafer 1.



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(54)【発明の名称】　半導体ウエハのハンドリング装置

(57)【要約】
【目的】　ウエハ裏面の汚染を防止し、同時にオリフラ位置に関わらずウエハをハンドの中心位置に自動心出しができるハンドリング装置を得る。
【構成】　半導体ウエハのハンドリング装置において、ハンドのアーム側把持部の両端の点が中心点になす開き角を、ウエハのオリフラ部の両端の点がウエハの中心点になす開き角の２倍以上とし、接触点を少なくとも両端の点と中央部の３点に設け、ハンドの先端側把持部の両端の点が中心点になす開き角を、ウエハのオリフラ部の両端の点がウエハの中心点になす開き角以上とし、接触点を少なくとも両端の２点に設け、オリフラの位置が把持部のどの位置にあっても、ウエハを把持する際に、両方把持部がそれぞれウエハと最初に接触する点を結んだ線とそれぞれの点をウエハ中心点と結んだ線がなす角度を、把持部とウエハとの摩擦角以上になるように設定した。

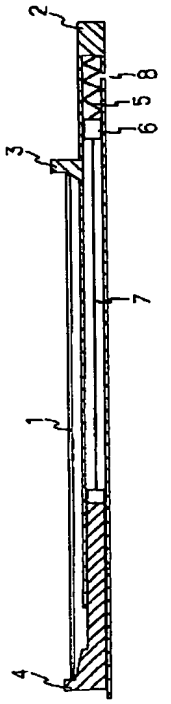

図２

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【特許請求の範囲】

【請求項１】　半導体ウエハの把持動作が終了した際、半導体ウエハ外周円に相当する円の中心位置を半導体ウエハ面と平行な面に投影した位置に中心点を有し、その中心点を通る平面上の中心線をハンドの中心線とし、半導体ウエハ外周円がはまりこむことができるほぼ同一直径の円の中心点を前記の中心点と同位置とし、当該円と前記ハンドの中心線と交わる２点の位置にそれぞれ中央部を有し、それぞれの中央部を通りハンド中心線に対称に当該円に沿った所定の範囲を半導体ウエハ外周部とだけ接触可能なハンド把持部とした半導体ウエハのハンドリング装置であって、ハンドのアーム側把持部の両端の点が中心点になす開き角を、半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角の２倍以上とし、接触点を少なくとも両端の点と中央部の３点に設け、ハンドの先端側把持部の両端の点が中心点になす開き角を、半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角以上とし、接触点を少なくとも両端の２点に設け、オリフラの位置がハンド把持部のどの位置にあっても、半導体ウエハを把持する際に、両方のハンド把持部がそれぞれ半導体ウエハと実際に最初に接触するであろう少なくともそれぞれの１箇所の点を結んだ線と、それぞれの点を半導体ウエハ中心点と結んだ線がなす角度を、ハンド把持部と半導体ウエハとの摩擦角以上になるように設定したことを特徴とする半導体ウエハのハンドリング装置。

【請求項２】　半導体ウエハの把持動作が終了した際、半導体ウエハ外周円に相当する円の中心位置を半導体ウエハ面と平行な面に投影した位置に中心点を有し、その中心点を通る平面上の中心線をハンドの中心線とし、半導体ウエハ外周円がはまりこむことができるほぼ同一直径の円の中心点を前記の中心点と同位置とし、当該円と前記ハンドの中心線と交わる２点の位置にそれぞれ中央部を有し、それぞれの中央部を通りハンド中心線に対称に当該円に沿った所定の範囲を半導体ウエハ外周部とだけ接触可能なハンド把持部とした半導体ウエハのハンドリング装置であって、ハンドのアーム側フィンガ部分の両端の点が中心点になす開き角を、半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角の２倍以上とし、それぞれの両端から中央部に向けてオリフラの前記開き角以上移動した点までをハンド把持部とし、接触点を少なくとも両端とそこから中央に向けてオリフラの前記開き角以上移動した点の４点とし、ハンドの先端側把持部の両端の点が中心点になす開き角を半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角以下とし、接触点を少なくとも両端の２点または中央の１点とし、オリフラの位置がフィンガ部分のどの位置にあっても、半導体ウエハを把持する際に、両方のハンド把持部がそれぞれ半導体ウエハと実際に最初に接触するであろう少なくともそれぞれ１箇所の

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点を結んだ線と、それぞれの点を半導体ウエハの中心点と結んだ線がなす角度を、ハンド把持部と半導体ウエハとの摩擦角以上になるように設定したことを特徴とした半導体ウエハのハンドリング装置。

【請求項３】　請求項１または請求項２に記載の半導体ウエハのハンドリング装置において、ハンドのアーム側及び先端側把持部の接触部の縦断面形状を半導体ウエハが入り込む上部の入り口部分の面の傾斜を半導体ウエハを把持した際の半導体ウエハ中心に向けた急傾斜面とし、その勾配を半導体ウエハの平坦な底面の円形外周の直径に近い位置に至るまで保ち、それよりハンド中心に向かった内部は、アーム側、先端側共ハンド平面より同じ高さから中心に向かった水平に近い円錐状の緩傾斜面としたことを特徴とする半導体ウエハのハンドリング装置。

【請求項４】　請求項１または請求項２に記載の半導体ウエハのハンドリング装置において、ハンドのアーム側把持部の接触部の縦断面形状を半導体ウエハ入り口部である上部では垂直に近い内壁面とし、それぞれハンド平面より同じ高さから中心に向かった部分を水平に近い円錐状の緩傾斜面にし、該アーム側把持部はハンドに固定し、先端側把持部の接触部の縦断面形状を入り口部ではアーム側把持部と同様の内壁と緩傾斜面にし、該先端側把持部の接触部を、単数または複数個の把持部とし、ハンドの中心点またはアーム側把持部に向かって引かれたり離れたりする可動部分としたことを特徴とする半導体ウエハのハンドリング装置。

【請求項５】　請求項１または請求項２に記載の半導体ウエハのハンドリング装置において、ハンドのアーム側把持部の接触部の縦断面形状を半導体ウエハ入り口部である上部では垂直に近い内壁面とし、それぞれハンド平面より同じ高さから中心に向かった部分を水平に近い円錐状の緩斜面にし、該アーム側把持部はハンドに固定し、先端側把持部の接触部分の縦断面形状を入り口部ではアーム側把持部と同様の内壁と緩斜面にし、該把持部の接触部を単数または複数個の把持部とし、ハンドの中心部またはアーム側把持部に向かって引かれたり離れたりすると同時に引かれる直前または直後に引かれる方向に対して直角に起立し、離れる時は立ち上がったまま離れる方向に移動した後、移動最終端またはその直前に水平に戻る構造になっていることを特徴とする半導体ウエハのハンドリング装置。

【請求項６】　請求項１または請求項３に記載の半導体ウエハのハンドリング装置において、アーム側把持部の急斜面を垂直面とし、当該垂直面を先端側把持部の高さより半導体ウエハの厚さ以上に高くしたことを特徴とする半導体ウエハのハンドリング装置。

【請求項７】　請求項１、２、４、５のうちいずれか１項に記載の半導体ウエハのハンドリング装置において、アーム側把持部の高さを先端側把持部の高さより半導体

ウエハの厚さ以上に高くしたことを特徴とする半導体ウエハのハンドリング装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、円形薄板状の部品を搬送するロボットハンド（以下、単にハンドと称する）を用いたハンドリング装置に関し、特に、信頼性の高い半導体装置を製造するための半導体ウエハ（以下、単にウエハと称する）のハンドリング装置に適用して有効な技術に関するものである。

【０００２】

【従来の技術】従来、半導体装置製造工程におけるウエハは、ウエハキャリアに収納され、各工程間を搬送されている。

【０００３】また、ウエハキャリアに収納されたウエハは、ハンドリング装置によって取り出され、前記ハンドリング装置とは別装置である中心合わせ装置に渡され、該中心合わせ装置でウエハの中心点のズレが補正され、再びハンドリング装置により、各処理装置にセットされている。

【０００４】また、各処理装置で所定の処理を施されたウエハは、ハンドリング装置によりウエハキャリアに収納されている。

【０００５】また、従来のウエハのハンドリング装置には、次の様なものがある。

【０００６】（１）裏面接触型

・ベルトがウエハの裏面に接触し搬送する。

・真空吸着部がウエハの裏面に吸いつき搬送する。

・支持台上をウエハをスライドさせ搬送する。

【０００７】（２）外周部垂直自然重力支持型

・ウエハを垂直に立てた状態で、ウエハ外周の上部及び下部を支持して搬送する。

・ウエハを傾斜させた状態で、ウエハ外周の下部を支持して搬送する。

【０００８】（３）ベルヌーイ・チャック型

・ウエハを流体動圧で支持して搬送する。

【０００９】（４）流体搬送型

・ウエハを液体又は気体の流れに入れて搬送する。

【００１０】また、従来のウエハの中心合わせ装置は、ウエハの裏面を支持台で支え、ウエハの側面から複数の円弧形状枠や、回転ローラや、垂直ピン等でウエハの側面を押して、前記支持台上を滑らせて中心を合わせている。

【００１１】また、通常、ウエハ（直径が約１５０mm：６インチ）は、ウエハキャリアに収納され、各工程間を搬送されている。

【００１２】ウエハキャリアはミル規格（米）に準拠し、現在一般的な６インチ径ウエハ用キャリアでは、ウエハは水平に４．７６mm（３／１６インチ）の等間隔に２５枚重畳して収納される。

【００１３】前記ウエハキャリアは、直径１５０±０．２mm程度のウエハに対し、各段支持棚の溝幅は、１５３．４２（±１．２）mmに作られ、０．２５mmの傾き誤差を容認される（たまたまオリフラ部分を支持する場合は、最大約０．４mm傾くことになる）。また、格段ピッチの製作許容公差（±０．１５mm）を加算し、ウエハ厚０．６mmとすれば、ウエハ間の空隙は平均３．９mm、最小３．６mm，更にオリフラ部を支えた場合の最小空隙は約３．４mmとなっている。

【００１４】

【発明が解決しようとする課題】しかしながら、本発明者は、前記従来技術を検討した結果、以下の問題点があることを見出した。

【００１５】従来のウエハのハンドリング装置は、ウエハの中心を合わせる手段を有していない。

【００１６】このため、ハンドリング装置でウエハキャリアから取り出したウエハを中心位置合わせ装置に渡し、中心のズレを補正し、再び、ハンドリング装置で各処理装置にセットしなければならない。

【００１７】このように、ハンドリング動作が複雑であるため、ウエハが汚染され、塵が発生する。

【００１８】このため、ウエハに異物が混入する。この結果、信頼性の高い半導体装置を製造し難いという問題があった。

【００１９】また、従来のウエハのハンドリング装置は、前述、ウエハの裏面にベルトや真空吸着部が接触するため、接触する部材がウエハ裏面を汚染する。また、ハンドリング中にウエハが削れて塵が発生する。

【００２０】このため、ウエハに異物が混入する。この結果、信頼性の高い半導体装置を製造し難いという問題があった。

【００２１】また、ウエハキャリアは、ウエハを支持するだけで、固定する機能を有していない。このため、ウエハがウエハキャリアに収納されている状態は、各段で揃っておらず、手前に引き出されたり、奥まで押しこまれたりした状態である。

【００２２】これにより、従来のハンドリング装置は、ウエハを確実に取り出すことができず、ウエハを破壊してしまうことがあった。

【００２３】この結果、半導体装置の歩留まりが低下するという問題があった。

【００２４】本発明の目的は、信頼性の高い半導体装置を製造することが可能なウエハのハンドリング装置を提供することにある。

【００２５】本発明の他の目的は、半導体装置の歩留まりを向上することが可能なウエハのハンドリング装置を提供することにある。

【００２６】本発明の他の目的は、ウエハの汚染を防止することが可能な技術を提供することにある。

【００２７】本発明の他の目的は、ハンドだけで半導体

ウエハの自動心出しをすることが可能な技術を提供することにある。

【００２８】本発明の他の目的は、ハンドだけで半導体ウエハ把持前にウエハ位置をハンド中心線の方向に揃えることが可能な技術を提供することにある。

【００２９】本発明の他の目的は、半導体ウエハを確実に把持することが可能な技術を提供することにある。

【００３０】本発明の前記ならびにその他の目的と新規な特徴は、本明細書の記述及び添付図面によって明らかになるであろう。

【００３１】

【課題を解決するための手段】本願において開示される発明のうち、代表的なものの概要を簡単に説明すれば、下記のとおりである。

【００３２】本発明の（１）の手段は、半導体ウエハの把持動作が終了した際、半導体ウエハ外周円に相当する円の中心位置を半導体ウエハ面と平行な面に投影した位置に中心点を有し、その中心点を通る平面上の中心線をハンドの中心線とし、半導体ウエハ外周円がはまりこむことができるほぼ同一直径の円の中心点を前記の中心点と同位置とし、当該円と前記ハンドの中心線と交わる２点の位置にそれぞれ中央部を有し、それぞれの中央部を通りハンド中心線に対称に当該円に沿った所定の範囲を半導体ウエハ外周部とだけ接触可能なハンド把持部（ハンドフィンガとも称する）とした半導体ウエハのハンドリング装置であって、ハンドのアーム側把持部（アーム側フィンガ）の両端の点が中心点になす開き角を、半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角の２倍以上とし、接触点を少なくとも両端の点と中央部の３点に設け、ハンドの先端側把持部（先端側フィンガ）の両端の点が中心点になす開き角を、半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角以上とし、接触点を少なくとも両端の２点に設け、オリフラの位置がハンド把持部のどの位置にあっても、半導体ウエハを把持する際に、両方のハンド把持部がそれぞれ半導体ウエハと実際に最初に接触するであろう少なくともそれぞれの１箇所の点を結んだ線と、それぞれの点を半導体ウエハ中心点と結んだ線がなす角度を、ハンド把持部と半導体ウエハとの摩擦角以上になるように設定したものである。

【００３３】本発明の（２）の手段は、半導体ウエハの把持動作が終了した際、半導体ウエハ外周円に相当する円の中心位置を半導体ウエハ面と平行な面に投影した位置に中心点を有し、その中心点を通る平面上の中心線をハンドの中心線とし、半導体ウエハ外周円がはまりこむことができるほぼ同一直径の円の中心点を前記の中心点と同位置とし、当該円と前記ハンドの中心線と交わる２点の位置にそれぞれ中央部を有し、それぞれの中央部を通りハンド中心線に対称に当該円に沿った所定の範囲を半導体ウエハ外周部とだけ接触可能なハンド把持部とした半導体ウエハのハンドリング装置であって、ハンドのアーム側フィンガ部分の両端の点が中心点になす開き角を、半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角の２倍以上とし、それぞれの両端から中央部に向けてオリフラの前記開き角以上移動した点までをハンド把持部とし、接触点を少なくとも両端とそこから中央に向けてオリフラの前記開き角以上移動した点の４点とし、ハンドの先端側把持部の両端の点が中心点になす開き角を半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角以下とし、接触点を少なくとも両端の２点または中央の１点とし、オリフラの位置がフィンガ部分のどの位置にあっても、半導体ウエハを把持する際に、両方のハンド把持部がそれぞれ半導体ウエハと実際に最初に接触するであろう少なくともそれぞれ１箇所の点を結んだ線と、それぞれの点を半導体ウエハの中心点と結んだ線がなす角度を、ハンド把持部と半導体ウエハとの摩擦角以上になるように設定したものである。

【００３４】本発明の（３）の手段は、前記（１）または（２）のウエハのハンドリング装置において、ハンドのアーム側及び先端側把持部の接触部の縦断面形状をウエハが入り込む上部の入り口部分の面の傾斜をウエハを把持した際のウエハ中心に向けた急傾斜面とし、その勾配をウエハの平坦な底面の円形外周の直径に近い位置に至るまで保ち、それよりハンド中心に向かった内部は、アーム側、先端側共ハンド平面より同じ高さから中心に向かった水平に近い円錐状の緩傾斜面としたものである。

【００３５】本発明の（４）の手段は、前記（１）または（２）のウエハのハンドリング装置において、ハンドのアーム側把持部の接触部の縦断面形状をウエハ入り口部である上部では垂直に近い内壁面とし、それぞれハンド平面より同じ高さから中心に向かった部分を水平に近い円錐状の緩傾斜面にし、この把持部はハンドに固定し、先端側の把持部の接触部の縦断面形状を入り口部ではアーム側把持部と同様の内壁と緩傾斜面にし、この把持部の接触部を、単数または複数個の把持部とし、ハンドの中心点またはアーム側把持部に向かって引かれたりはなれたりする可動部分としたものである。

【００３６】本発明の（５）の手段は、前記（１）または（２）のウエハのハンドリング装置において、ハンドのアーム側把持部の接触部の縦断面形状をウエハ入り口部である上部では垂直に近い内壁面とし、それぞれハンド平面より同じ高さから中心に向かった部分を水平に近い円錐状の緩斜面にし、この把持部部分はハンドに固定し、先端側の把持部の接触部分の縦断面形状を入り口部ではアーム側把持部と同様の内壁と緩斜面にし、この把持部の接触部を単数または複数個の把持部とし、ハンドの中心部またはアーム側把持部に向かって引かれたり離れたりすると同時に引かれる直前又は直後に引かれる方

向に対して直角に起立し、離れる時は立ち上がったまま離れる方向に移動した後、移動最終端またはその直前に水平に戻る構造になっている。

【００３７】本発明の（６）の手段は、前記（１）または（３）のウエハのハンドリング装置において、アーム側把持部の急斜面を垂直面とし、当該垂直面を先端側把持部の高さよりウエハの厚さ以上に高くしたものである。

【００３８】本発明の（７）の手段は、前記（１）、（２）、（４）、（５）の手段のうちいずれか１つのウエハのハンドリング装置において、アーム側把持部の高さを先端側把持部の高さよりウエハの厚さ以上に高くしたものである。

【００３９】

【作用】上述した手段によれば、３つ以上の接触点でウエハを把持することにより、把持部との位置関係によりウエハの中心点の位置を特定できるので、ウエハの中心の位置合わせができ、ウエハキャリアから取り出したウエハを中心位置合わせ装置に渡し、中心のズレを補正し、ハンドリングし、各処理装置にセットする必要が無い。また、ウエハのハンドリングの工数が減るので、ウエハのハンドリング時に混入する異物が減る。これにより、信頼性の高い半導体装置を製造することが可能となる。

【００４０】また、ウエハの裏面にハンドリング装置が接触しないので、ハンドリング時にウエハが削れず、塵が発生しない。これにより、信頼性の高い半導体装置を製造することが可能となる。

【００４１】また、前記把持部のハンドリング装置の支持腕側の一部が、前記把持部の他の部分よりも、高さが前記ウエハの厚さ以上に高くすることはにより、ウエハをウエハキャリアに押しこみ、揃えることができるので、ウエハを確実に把持することができる。これにより、ハンドリング時にウエハが破壊されないので、半導体装置の歩留りを向上することが可能となる。

【００４２】

【実施例】以下、図面を参照して本発明の実施例について詳細に説明する。

【００４３】なお、実施例を説明するための全図において、同一機能を有するものは同一符号を付け、その繰り返しの説明は省略する。

【００４４】（実施例１）図１は、本発明による実施例１の引き寄せ式半導体ウエハのハンドリング装置の概略構成を示す平面図、図２は、図１に示すＹ－Ｙ線で切った断面図である。

【００４５】図１及び図２において、１は半導体ウエハ、１Ａはウエハ１のオリフラ、２はハンドリング装置を支持するためのアームである。

【００４６】また、３はウエハ１を把持するためのアーム２側に設けられたアーム側把持部（アーム側フィンガ）、４はウエハ１を把持するためのアーム側把持部３と対向して設けられた先端側把持部（先端側フィンガ）である。

【００４７】また、５は先端側把持部４を所定の位置に戻すためのバネ、６はバネ５により可動するピストン、７はピストン６の動きを先端側把持部４に伝えるロッド、８はピストン６を可動させるために真空引きするための吸引口である。

【００４８】本実施例１のウエハ１のハンドリング装置は、図１に示すように、アーム２にアーム側把持部３及び先端側把持部４が互いに対抗して設けられている。

【００４９】前記アーム側把持部３及び先端側把持部４は、ウエハ１の外周部と接触する３つ以上の接触点を有している。

【００５０】前記接触点は、前記ウエハ１が前記接触点との摩擦により静止しない位置に設けられ、また、前記接触点を移動させて、ウエハ１の位置のずれを補正するために、先端側把持部４を滑動させる。その詳細な構成について図３を用いて説明する。

【００５１】図３は、キヤリア内のリブＳに２点で支えられたウエハ１に対してハンドが下面に挿入された状態を示す平面図である。

【００５２】アーム側把持部３は、接触点Ａ，Ｂ，Ｂ’を備え、その位置は中心部にＡ点を、そこからオリフラ１Ａの開き角δにほぼ等しい開き角αの位置にＢ，Ｂ’点を備えている。図３では、オリフラ１Ａの位置は、アーム側把持部３の位置に対し反時計方向に微小角回転させ、両端の位置がＡ，Ｂ両点より上方に少しずれた状態を示している。

【００５３】先端側把持部４は、接触点Ｃ，Ｃ’を備え、把持時に開き角αの位置に配置されており、図３の状態ではハンド本体に入っている。

【００５４】また、アーム側把持部３及び先端側把持部４の底部には、図２に示すように、垂直壁３ａ，４ａから中央に向って緩斜面３ｂ，４ｂが設けられている。そして、アーム側把持部３は先端側把持部４よりも高く（ウエハ１の厚さ以上に）なっている。

【００５５】すなわち、前記アーム側把持部３及び先端側把持部４は、ウエハ１の把持動作が終了した際、ウエハ１の外周円に相当する円の中心位置をウエハ面と平行な面に投影した位置に中心点Ｏを有し、その中心点Ｏを通る平面上の中心線をハンドの中心線とし、ウエハ１の外周円がはまりこむことができるほぼ同一直径の円の中心点を前記の中心点Ｏと同位置とし、当該円と前記ハンドの中心線と交わる２点の位置にそれぞれ中央部を有し、それぞれの中央部を通りハンド中心線に対称に当該円に沿った所定の範囲をウエハ１の外周部とだけ接触可能なハンド把持部であって、ハンドのアーム側把持部３の両端のＢ，Ｂ’点が中心点Ｏになす開き角２αを、ウエハ１のオリフラ１Ａの両端の点がウエハ１の中心点Ｏ

になす開き角（オリフラ角）δの２倍以上とし、例えば、接触点を少なくとも両端Ｂ，Ｂ’の点と中央部Ａの３点に設け、ハンドの先端側把持部３の両端の点Ｃ，Ｃ’が中心点Ｏになす開き角αを、ウエハ１のオリフラ１Ａの両端の点がウエハ１の中心点Ｏになす開き角δ以上とし、接触点を少なくとも両端の２点（例えば、ｃ，ｃ’点）に設け、オリフラ１Ａの位置がハンド把持部のどの位置にあっても、ウエハ１を把持する際に、両方のアーム側把持部３及び先端側把持部４がそれぞれウエハ１と実際に最初に接触するであろう少なくともそれぞれの１箇所の点（例えば、Ａ点）を結んだ線（例えば、ａ点とｃ点と結んだ線）と、それぞれの点をウエハ１の中心点Ｏと結んだ線がなす角λを、アーム側把持部３及び先端側把持部４とウエハ１との摩擦角以上になるように設定されている。

【００５６】次に、本実施例１のウエハのハンドリング装置の把持動作を説明する。

【００５７】本実施例１のウエハのハンドリング装置（引き寄せ式）は、図２及び図３に示すように、真空引きによりピストン６を可動させると、図２に示すように、先端側把持部４が右に引き込まれ、ウエハ１が、図３に示すように、上側に偏心しており、オリフラ１Ａが前記の位置にある場合を考える。

【００５８】この時、先端側把持部４の接触点Ｃは、ウエハ１のＣ点と接触してウエハ１をアーム側把持部３の垂直壁３ａに接触させる。その瞬間、最初に接触するのはウエハのａ点とアーム側把持部３のＡ点となる。その結果、挟み角λが生じ、これが摩擦角を上回ればＡ，Ｃ点の両方又は一方が滑り、偏心矯正され、Ｂ’，Ｃ’点のいずれかの点と接触し、把持が完了する。そして、キャリアのリブＳから離れる。

【００５９】また、オリフラ１Ａの位置がＣ，Ｃ’位置で同様に偏心している場合は、Ｃ’，Ｂ点で挟み角λを生ずる。あらゆるオリフラ位置への対応検討については後述する。

【００６０】このように、本実施例１のハンドリング装置の把持動作は、吸引口８から真空引きするとバネ５のバネ力を抗してピストン６が動き、ロッド７を介して先端側把持部４を滑動させる。これにより、アーム側把持部３と、先端側把持部４とでウエハ１を把持する。また、真空引きを解除すると、バネ５によってもとの状態にもどる。

【００６１】ここで、本発明による半導体ウエハのハンドリング装置の自動偏心矯正作用の原理について本実施例１を用いて説明する。

【００６２】ウエハ１を安定かつ確実に把持するためには、把持前のウエハ１とハンドの相対位置が違っていても、把持後はハンドの所定の位置にウエハ１があることが望ましい。それには、把持動作でウエハ１の中心に移動させる偏心矯正機能を持つことが必要である。

【００６３】図４は、ウエハ１のような円形平板を円弧部分のＡ，Ｃ点に力を加えて中心を移動させる原理を説明するための図であり、ウエハ１の外周円弧部のＡ，Ｃ点の２点にウエハ１の中心点Ｏに向かう二つの力が作用した場合である。図５は、力の作用点の一つがオリフラ１Ａ部にかかったときを示す図である。

【００６４】図４及び図５において、各点の力Ｆは分力Ｆｒ（数１），Ｆｔ（数２）に分解され、分力Ｆｔに対抗する摩擦力μＦ（μは摩擦係数）が発生する。この合力Ｆｅは、数３のようになり、数４の条件が満たされれば、Ａ，Ｂ点両方または一方にウエハ１と接触する部分と滑り、または転がりによる相対変位が生じ、図５の（ａ）図に示すように、中心点Ｏは矢印方向へ自動的に移動して偏心矯正される。

【００６５】Ｆは接触点Ａ及び接触点Ｃから中心点Ｏに向かう力、λは接触点Ａと接触点Ｃと中心点Ｏとでなす挟み角（∠ＯＡＢ、∠ＯＢＡ）とすると、分力ＦｔとＦｒは次式数１，２で表される。

【００６６】

【数１】　　$Fr = F / \cos\lambda$

【００６７】

【数２】　　$Ft = \tan\lambda$

合力Ｆｅは分力Ｆｔと摩擦力μＦの合力であり、次式数３，数４で表される。

【００６８】

【数３】　　$Fe = 2(Ft - \mu F)\cos\lambda = 2(\sin\lambda - \mu\cos\lambda)F > 0$

【００６９】

【数４】　　$\mu < \tan\lambda$

図５の（ａ）図及び（ｂ）図は、オリフラ位置に一つの作用点が掛かった場合で、ここでは力ＦがＦ’のようにλ’だけ傾く。したがって、図５の（ｂ）図のＣ点のように、矯正方向と逆方向に力Ｆｔ’が発生する場合が生ずる。したがって、この点は動かず、Ａ点だけが矯正作用を生ずる。その時のＦｒ，Ｆｔ’は次式数５，数６で表される。

【００７０】

【数５】　　$Fr = F' / \cos(\lambda \pm \lambda')$

【００７１】

【数６】　　$Ft' = \tan(\lambda \pm \lambda')$

図６は、前記アーム側把持部３及び先端側把持部４がウエハ１の外周で偏心矯正機能を保つ限界の配置を説明するための図であり、（ａ）図，（ｂ）図，（ｃ）図は、それぞれオリフラ１Ａがアーム側把持部３にある場合、（ａ’）図，（ｂ’）図，（ｃ’）図は、それぞれオリフラ１Ａが先端側把持部４にある場合を示している。

【００７２】（ａ）図はオリフラ端部がアーム側把持部３の中央部のＡ点と端部のＢ点の近くにかかった場合である。前述のようにウエハが上方に偏心しているとすると、Ｂ点は接触せず、Ａ，Ｃ両点を結んだ線とそれぞれ

の点をウエハ１の中心点Ｏと線がなす挟み角λを発生させる。(ａ')図は同様にＢ，Ｃ'両点で挟み角λを発生させる。

【００７３】前記の関係はＡ，Ｂ，Ｃ３点の幾何学上の相対位置を変えない限り成立する。(ｂ)図，(ｂ')図は、(ａ)図を反時計回りにβだけ回転させた配置である。

【００７４】次に、本発明による半導体ウエハのハンドリング装置のウエハ偏心時の偏心矯正作用角の変化に伴う修正について説明する。

【００７５】図７及び図８は、ウエハ１の偏心を誇張して示した図であり、図７の(ａ)，(ａ')図は、図６の(ａ')図，(ａ)図に相当し、図８は図６の(ｃ)に相当する。

【００７６】図７及び図８からわかるように、ウエハ１の偏心によってアーム側把持部３及び先端側把持部４の開き角αが有効に作用しないので、その分あらかじめ開き角αに余裕を持つ必要がある。挟み角λと摩擦角の関係は、εを偏心修正角とすると、次式数７のようになる。

【００７７】

【数７】　　λ＝α－ε

ちなみに、ウエハ１の直径が６インチの場合で、計算上ウエハ１の偏心ｅが３㎜のとき、分力Ｆｔと摩擦力μＦが等しくなる挟み角λは、約２．３度、８インチの場合で約１．７度である。

【００７８】次に、本発明によるウエハ偏心矯正方法とハンドフィンガ（アーム側把持部３及び先端側把持部４）の薄型化について説明する。

【００７９】図９は、急傾斜に矯正力によって安定した姿勢に治まる過程を想定した図、図１０は、偏心矯正可能な最も厳しいオリフラ位置について想定した全ての図を偏心を誇張して示したもので、図６の(ａ)，(ａ')図の場合に付いて、ウエハ１が上方の右または左に偏心した状態である。

【００８０】ウエハ１のオリフラ１Ａの開き角δを上回る範囲にアーム側把持部３及び先端側把持部４の両把持部を設けた場合、ウエハ外周の円弧部の一点が必ず急傾斜面に掛かり、そこから１８０度の方向のｘ点が円弧部でしかも緩傾斜面がそこにあれば、この２点で支えることになる。(ａ-1)図ではａ点、(ａ-2)図ではｃ点、(ａ'-1)図ではｂ点、(ａ'-2)図ではｃ点が急傾斜面上の高い位置に載っている。(ａ-1)，(ａ-2)，(ａ'-2)図の場合は、ｘ点が緩傾斜面上にある。(ａ'-1)図の場合は、アーム側把持部３及び先端側把持部４から外れ、ｃ'，ｂ'点が支持点となる。

【００８１】図１１は、前記の状態でウエハ１の自重が矯正力を発生する原理を説明するための図であり、

（ａ）図は縦断面図、（ｂ）図は（ａ）図の平面図である。代表として図１１の（ａ-1）図のａ点における場合

を選んで示したものである。初期にａ、ｘ点に発生する力を（ａ）図に、矯正力発生時の力を（ｂ）図に示す。

【００８２】図１１の（ａ）図に示すウエハ重力Ｗは、数８のように表される。この力により数９、数１１のようなＱ'、Ｑ、Ｒ、Ｒ'が発生する。そのうち、Ｒ、Ｒ'は傾斜角を滑り降りる力に対する抵抗力を発生させ、滑り降りる力Ｆは数１１、１２で表される。そこで、急傾斜角φが９０°に近く緩傾斜角ψが０°に近ければ数１３に示すＦの値になる。この力によって、ａ点が力Ｆで滑り降りると、図１１において（ａ-1）図ではｃ点がＣ点に、（ａ-2）図ではａ点がＡ点に、（ａ'-1）図ではｃ'点がＣ'点に、（ａ'-2）図ではｂ点がＢ点に近かずき接触する。（ａ'-1）図の場合は、ｃ'、ｂ'が接触しており、数８でウエハ重力は３点に分配され、滑り降りる力は増加するが、詳細な数式説明は省略する。その瞬間に、図１１の（ｂ）図の力が発生し数３と同様な数１４に示す力が発生し、図９の（ｂ）図の安定状態に達する前に偏心矯正作用が働く。

【００８３】図１２は、この原理を用いたハンドフィンガ（アーム側把持部３及び先端側把持部４）の配置例を示し、（ａ）図は平面図、（ｂ）図は断面図である。この図１２は、オリフラ位置がアーム側と先端側にある場合を重ねて示している。

【００８４】

【数８】　　Ｗ＝Ｗ／２＋Ｗ／２

【００８５】

【数９】　　Ｑ＝（Ｗ／２）ｓｉｎφ、　　Ｑ'＝（Ｗ／２）ｓｉｎψ

【００８６】

【数１０】　　Ｒ＝（Ｗ／２）ｃｏｓφ、　　Ｒ'＝（Ｗ／２）ｃｏｓψ

【００８７】

【数１１】　　Ｆ＝（Ｑ－μＲ）ｓｉｎφ－（Ｑ'＋μＲ'）ｓｉｎψ

【００８８】

【数１２】　　＝(Ｗ／２){(ｓｉｎφ－μｃｏｓφ)ｓｉｎφ－(ｓｉｎψ－μｃｏｓψ)ｓｉｎψ}

【００８９】

【数１３】　　Ｆ＝(Ｗ／２)(１－μ)＞０

【００９０】

【数１４】　　F_0＝２(Ｆｔ－μＦｒ)＝２Ｆ(ｓｉｎλ－μｃｏｓλ)ｃｏｓλ(ｓｉｎλ－μｃｏｓλ)＞０、ｔａｎλ＞μ

（実施例２）図１３は、本発明による実施例２の起伏式半導体ウエハのハンドリング装置の概略構成を示す平面図、図１４は、図１３に示すＹ－Ｙ線で切った断面図、図１５は、起伏式のハンドリング装置の先端側把持部の起伏動作を説明するための要部断面図である。

【００９１】図１３，図１４及び図１５において、９はロッド７と先端側把持部４を連結する連結片、１０はヒ

ンズ等からなる回動軸、１１は傾斜面部材である。

【００９２】本実施例２のウエハ１のハンドリング装置は、図１３及び図１４に示すように、アーム２にアーム側把持部３及び先端側把持部４が互いに対抗して設けられている。

【００９３】また、アーム側把持部３及び先端側把持部４は、ウエハ１の外周部と接触する３つ以上の接触点を有している。

【００９４】また、前記接触点は、前記ウエハ１が前記接触点との摩擦により静止しない位置に設けられ、また、前記接触点を移動させて、ウエハの位置のずれを補正するために、先端側把持部４を起伏し、ウエハ１に対して接触及び離反させている。

【００９５】また、アーム側把持部３は先端側把持部４よりもウエハ１の厚さ以上に高くなっている。

【００９６】本実施例２の起伏式半導体ウエハのハンドリング装置の把持動作は、吸引口８から真空引きするとバネ５のバネ力を抗してピストン６が動き、ロッド７と、連結片９を介して先端側把持部４が動く。先端側把持部４は、ハンドの傾斜面部材１１が固定されているため、回動軸１０を中心に回動し、図１５の（ａ）図の状態から（ｂ）図に示すように起伏し、さらに（ｃ）図に示すようにウエハ１に対して近づき、接触する。これにより、アーム側把持部３と、先端側把持部４とでウエハ１を把持する。また、真空引きを解除すると、バネ５によって図１５の（ｃ）の状態から（ｂ）図に示す状態しなり、さらに（ａ）図の状態にもどる。

【００９７】（実施例３）図１６は、本発明による実施例３の重力式半導体ウエハのハンドリング装置の概略構成を示す平面図、図１７は、図１６に示すＹ－Ｙ線で切った断面図である。

【００９８】図１６及び図１７において、２０はアーム側把持部３及び先端側把持部４に設けられた緩傾斜部、２１はアーム側把持部３及び先端側把持部４に設けられた急傾斜部である。

【００９９】本実施例３のウエハ１のハンドリング装置は、図１６及び図１７に示すように、アーム２にアーム側把持部３及び先端側把持部４が互いに対抗して設けられている。

【０１００】また、アーム側把持部３及び先端側把持部４は、ウエハ１の外周部と接触する３つ以上の接触点を有している。

【０１０１】また、前記接触点は、前記ウエハ１が前記接触点との摩擦により静止しない位置に設けられている。

【０１０２】また、アーム側把持部３は先端側把持部４よりも高く、かつ、ウエハ１の厚さ以上に高くなっている。

【０１０３】また、アーム側把持部３及び先端側把持部４に緩傾斜部２０と急傾斜部２１が設けられている。

【０１０４】本実施例３の重力式半導体ウエハのハンドリング装置の把持動作は、まず、ウエハ１を収納したウエハキャリアにハンドリング装置を挿入し、この時、アーム側把持部３の高くなった部分でウエハ１をウエハキャリアに押し込んで揃える。

【０１０５】次に、ウエハ１を持ち上げる。この時、ウエハ１は円周部でのみ、アーム側把持部３及び先端側把持部４と接触している。そして、ウエハ１は、急傾斜部２１上を滑り、ウエハ円周が急傾斜部２１と緩傾斜部２０との境と一致したところで静止する。これにより、ウエハ１の裏面に接触せずにウエハを把持することができる。

【０１０６】前述のように、アーム側把持部３及び先端側把持部４はアーム２に固定されているので、アーム側把持部３及び先端側把持部４と把持されたウエハ１との位置関係により、当該ウエハ１の中心位置Ｏの位置を特定することができる。つまり、ウエハ１の中心位置合わせができる。

【０１０７】これにより、本実施例３のハンドリング装置は、実施例１、２と同様の効果を得ることができる。

【０１０８】また、本実施例３のハンドリング装置は、アーム側把持部３及び先端側把持部４が可動しないので、構造が簡単である。このため、ハンドリング装置の厚さは、ウエハ１を支えるための強度があれば良いので、本実施例３のハンドリング装置は厚さを薄くすることができる。この結果、ウエハキャリアに収納されたウエハ間の隙間に差し入れることが可能である。

【０１０９】ここで、キャリア対応時のハンドフィンガの寸法制限への対応について説明する。

【０１１０】まず、最初に一番寸法的に厳しい条件が課せられるのが、キャリアからの出し入れである。図１８は、ウエハキャリアのミル規格（米）に準拠した６インチ径のウエハ用キャリアの概略構成を示す図であり、（ａ）図は正面図、（ｂ）図は（ａ）図のＹ－Ｙ線で切った断面面、（ｃ）図はＯ印で囲んだ部分の拡大図である。

【０１１１】図１８に示すように、キャリア３０の基準面を水平に置とき、ウエハ１は水平に称呼寸法３／１６インチ（４．７６㎜）の等間隔に２５枚重畳して収納される。

【０１１２】格段のウエハ支持要領は、図１８に示すように、約４．６度の浅い勾配面上にウエハ１の重心Ｏを通る直径の両周端が載り両端Ｔ２点で支持される。直径１５０±０．２㎜に作られ、０．２５㎜の傾き誤差を容認される（たまたまオリフラ部分を支持する場合は、最大約０．４㎜傾くことになる）。

【０１１３】また、格段ピッチの製作許容公差（±０．１５㎜）を加算し、ウエハ厚０．６㎜とすれば、ウエハ１間の空隙は平均３．９㎜、最小３．６㎜、さらに、オリフラ部を支えた場合の最小空隙は平均３．４㎜とな

る。

【０１１４】また、キャリアの基面近くに、最下段ウエハに対面して図のようにキャリアケージの左右両側板を連結するビーム３０ａが通るので、最下段ウエハ１の出し入れの際は、このビーム上面との間隙をハンドフィンガが通過するが、この空隙距離は平均３．７５㎜、最小３．３㎜と推計される。

【０１１５】前記ウエハ段間の最小間隙３．４㎜、最下端で３．３㎜の挟い空間をウエハ直径にわたり通過するウエハ支持体（ハンド）の許される厚み（高さ）は上下クリアランスをそれぞれ０．５㎜確保するものとして２㎜そこそこの薄板状の限界寸法内に構成する必要がある。同様の推計を８インチウエハについて行うと、４㎜が限界寸法となる。

【０１１６】以上、発明者によってなされた発明を実施例にもとづき具体的に説明したが、本発明は前記実施例に限定されるものではなく、その要旨を逸脱しない範囲で種々変更可能であることはいうまでもない。

【０１１７】

【発明の効果】本願において開示される発明のうち代表的なものによって得られる効果を簡単に説明すれば、下記のとおりである。

（１）ウエハの裏面に接触しないので、汚染が防止できる。

（２）ハンドだけでウエハの自動心出しができる。

（３）ハンドだけでウエハ把持前にウエハ位置をハンド中心線の方向に揃えることができる。

（４）ウエハを確実に把持することができる。

（５）前記（１）乃至（４）により、信頼性の高い半導体装置を製造することが可能となり、半導体装置の歩留まりを向上させることが可能となる。

【図面の簡単な説明】

【図１】　本発明による実施例１の引き寄せ式半導体ウエハのハンドリング装置の概略構成を示す平面図、

【図２】　図１に示すＹ－Ｙ線で切った断面図、

【図３】　本実施例１のキヤリア内のリブに２点で支えられたウエハに対してハンドが下面に挿入された状態を示す平面図、

＊【図４】　本発明によるウエハのような円形平板を円弧部分のＡ，Ｃ点に力を加えて中心を移動させる原理を説明するための図、

【図５】　本発明による力の作用点点の一つがオリフラ部にかかったときを示す図、

【図６】　本発明によるアーム側把持部及び先端側把持部がウエハの外周で偏心矯正機能を保つ限界の配置を説明するための図、

【図７】　ウエハの偏心を誇張して示した図、

【図８】　ウエハの偏心を誇張して示した図、

【図９】　矯正力によって安定した姿勢に治まる過程を想定した図、

【図１０】　偏心矯正可能な最も厳しいオリフラ位置について想定した偏心を誇張して示した図、

【図１１】　本発明によるウエハの自重が矯正力を発生する原理を説明するための図、

【図１２】　本発明によるハンドフィンガ（アーム側把持部及び先端側把持部）の配置例を示した図、

【図１３】　本発明による実施例２の起伏式半導体ウエハのハンドリング装置のの概略構成を示す平面図、

【図１４】　図１４に示すＹ－Ｙ線で切った断面図、

【図１５】　本実施例２の起伏式半導体ウエハのハンドリング装置の先端側把持部の起伏動作を説明するための要部断面図、

【図１６】　本発明による実施例３の重力式半導体ウエハのハンドリング装置の概略構成を示す平面図、

【図１７】　図１７に示すＹ－Ｙ線で切った断面図、

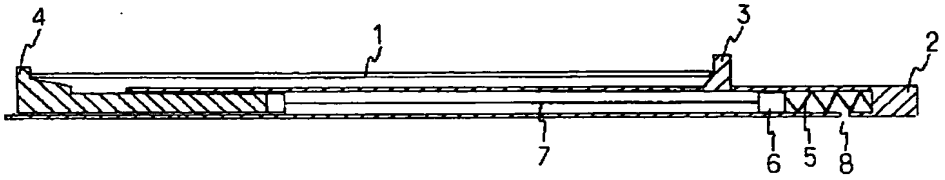
【図１８】　本発明に係るウエハキャリアのミル規格（米）に準拠した６インチ径のウエハ用キャリアの概略構成を示す図。

【符号の説明】

１…ウエハ、１Ａ…オリフラ、２…アーム、３…アーム側把持部（アーム側フィンガ）、４…先端側把持部（先端側フィンガ）、５…バネ、７…ロッド、８…吸引口、９…連結片、１０…回動軸、１１…傾斜面部材、２０…緩傾斜部、２１…急傾斜部、Ａ、Ｂ、Ｃ…接触点、Ｆ…力、Ｏ…中心点、μ…摩擦係数、λ…挟み角、δ…オリフラ角。

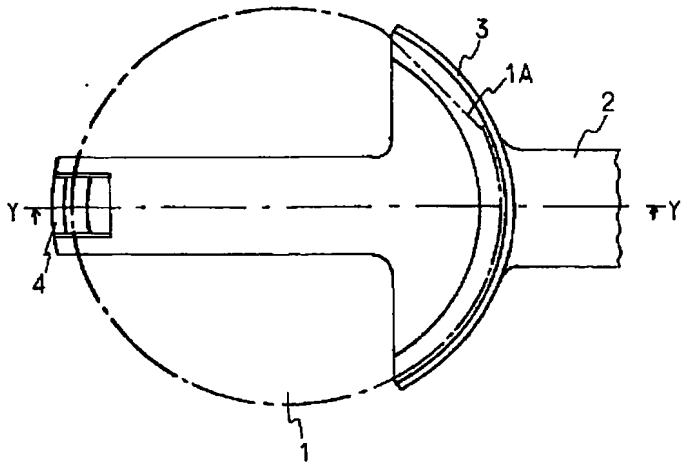
【図２】

図2



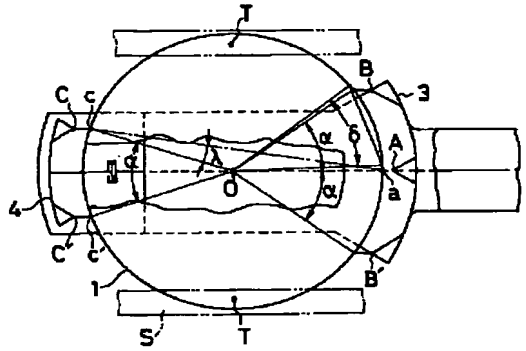
【図1】

図1



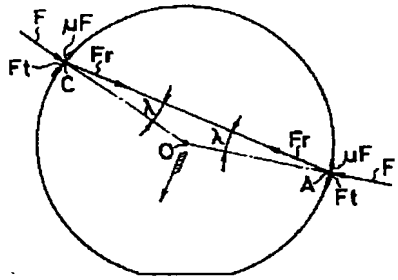
【図3】

図3



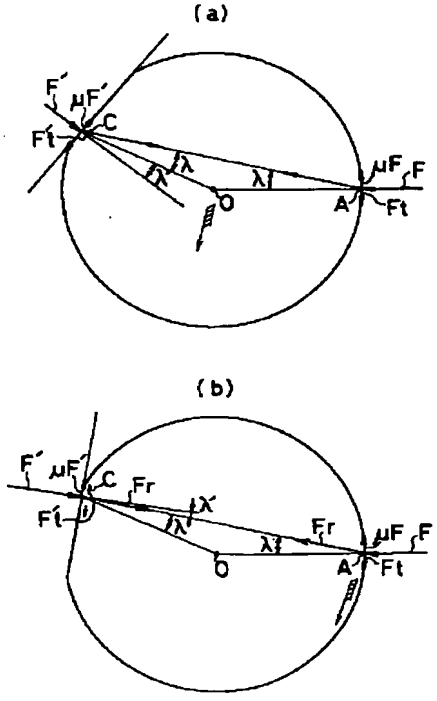
【図4】

図4



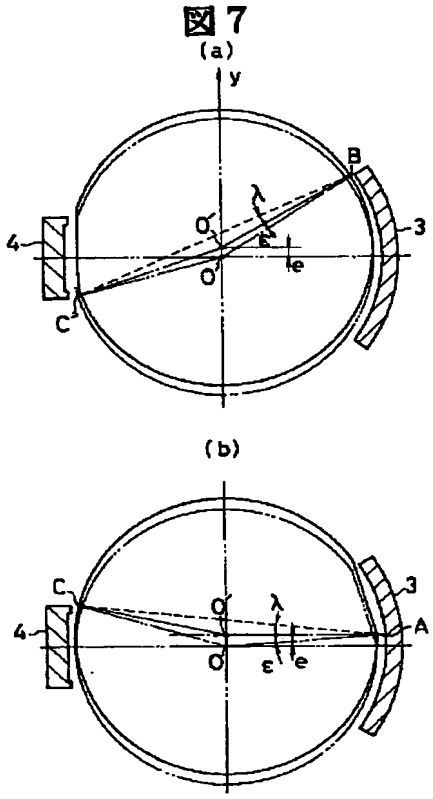
【図5】

図5



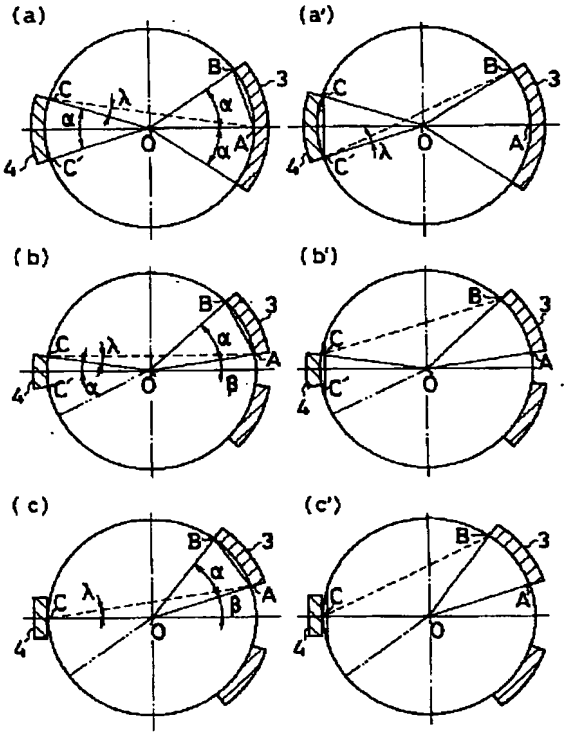
【図7】

図7



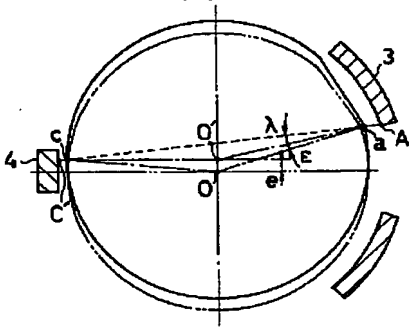
【図６】

図６



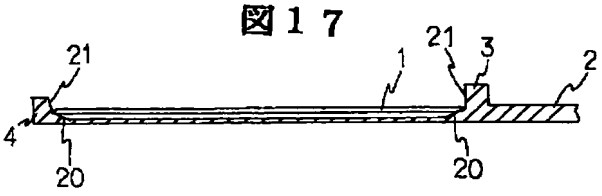
【図８】

図８



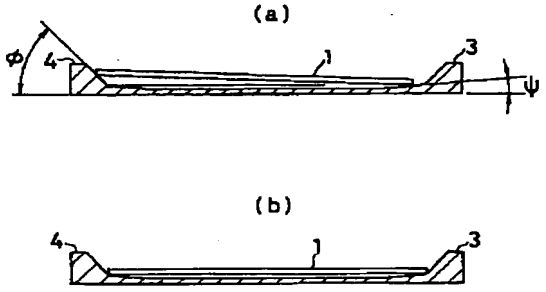
【図１７】

図１７



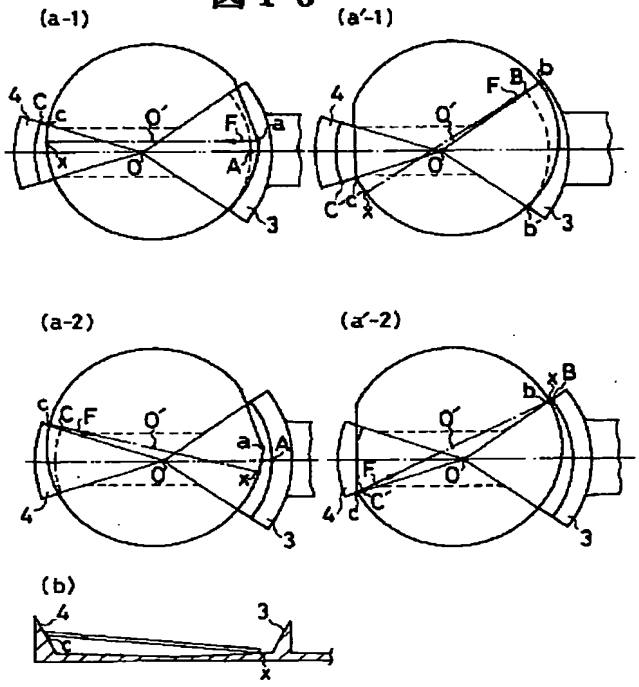
【図９】

図９



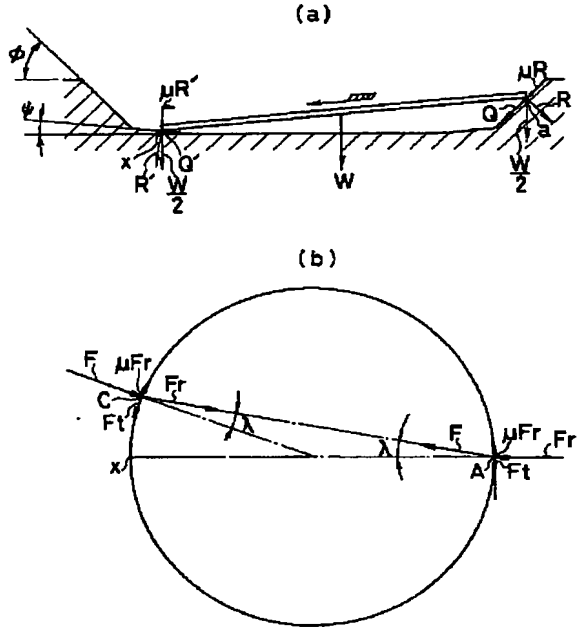
【図１０】

図１０



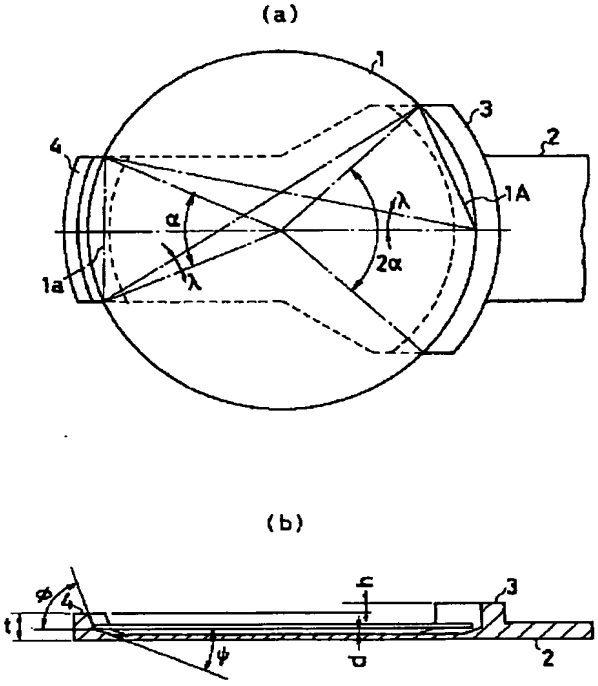
【図１１】

図１１



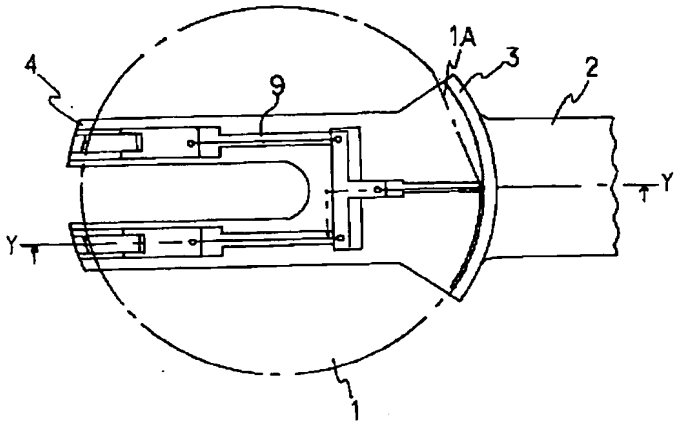
【図１２】

図１２



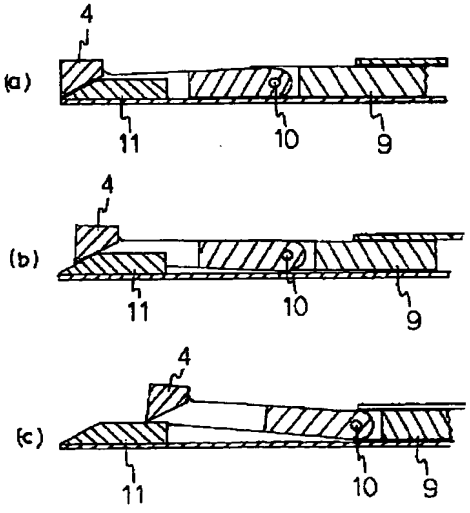
【図１３】

図１３



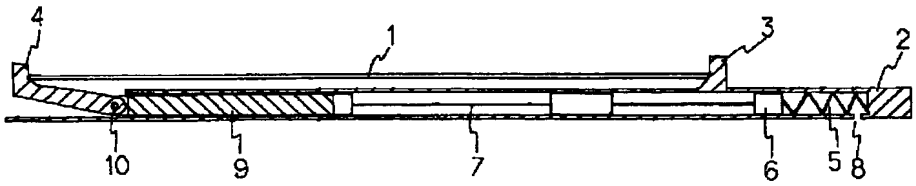
【図１５】

図１５



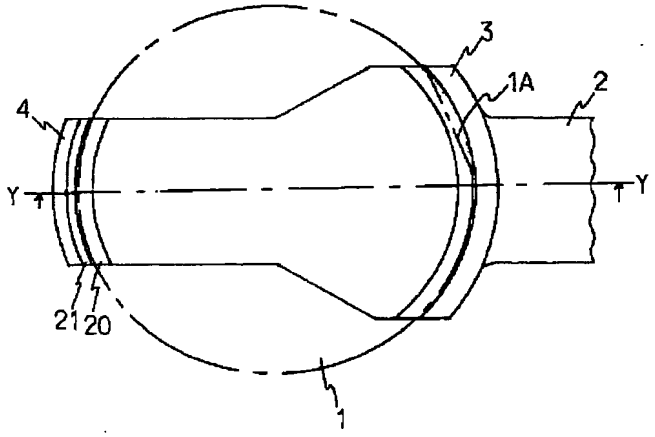
【図１４】

図１４



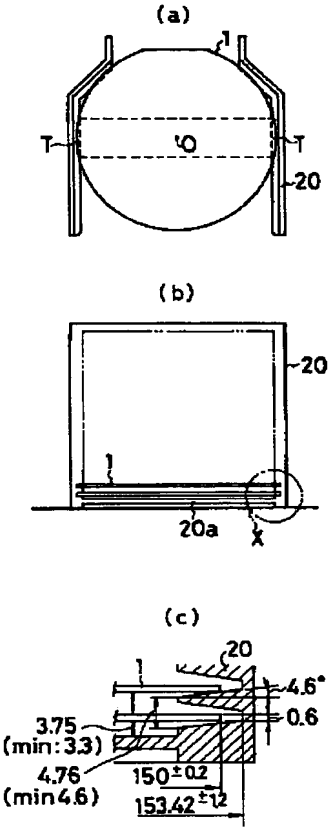
【図１６】

図16



【図１８】

図１８



【公報種別】特許法第１７条の２の規定による補正の掲載
【部門区分】第７部門第２区分
【発行日】平成１３年６月２９日（２００１．６．２９）

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【年通号数】公開特許公報７－２２６
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【国際特許分類第７版】
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H01L 21/68 S
A
B25J 15/08 Z

【手続補正書】
【提出日】平成１２年６月１３日（２０００．６．１３）
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】特許請求の範囲
【補正方法】変更
【補正内容】
【特許請求の範囲】
【請求項１】 半導体ウエハの外周部を把持するための急傾斜面と、偏心して載置された半導体ウエハの外周部が倣って前記急傾斜面へ到達するための案内面となる緩傾斜面とを持つ把持部が複数備えられ、前記複数の把持部の把持動作によって、半導体ウエハの中心が所定位置に把持されることを特徴とする半導体ウエハのハンドリング装置。
【請求項２】 半導体ウエハの把持動作が終了した際、半導体ウエハ外周円に相当する円の中心位置を半導体ウエハ面と平行な面に投影した位置に中心点を有し、その中心点を通る平面上の中心線をハンドの中心線とし、半導体ウエハ外周円がはまりこむことができるほぼ同一直径の円の中心点を前記の中心点と同位置とし、当該円と前記ハンドの中心線と交わる２点の位置にそれぞれ中央部を有し、それぞれの中央部を通りハンド中心線に対称に当該円に沿った所定の範囲を半導体ウエハ外周部とだけ接触可能なハンド把持部とした半導体ウエハのハンドリング装置であって、ハンドのアーム側把持部の両端の点が中心点になす開き角を、半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角の２倍以上とし、接触点を少なくとも両端の点と中央部の３点に設け、ハンドの先端側把持部の両端の点が中心点になす開き角を、半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角以上とし、接触点を少なくとも両端の２点に設け、オリフラの位置がハンド把持部のどの位置にあっても、半導体ウエハを把持する際に、両方のハンド把持部がそれぞれ半導体ウエハと実際に最初に接触するであろう少なくともそれぞれの１箇所の点を結んだ線と、それぞれの点を半導体ウエハ中心点と結んだ線がなす角度を、ハンド把持部と半導体ウエハとの摩擦角以上になるように設定したことを特徴とする半導体ウエハのハンドリング装置。
【請求項３】 半導体ウエハの把持動作が終了した際、半導体ウエハ外周円に相当する円の中心位置を半導体ウエハ面と平行な面に投影した位置に中心点を有し、その中心点を通る平面上の中心線をハンドの中心線とし、半導体ウエハ外周円がはまりこむことができるほぼ同一直径の円の中心点を前記の中心点と同位置とし、当該円と前記ハンドの中心線と交わる２点の位置にそれぞれ中央部を有し、それぞれの中央部を通りハンド中心線に対称に当該円に沿った所定の範囲を半導体ウエハ外周部とだけ接触可能なハンド把持部とした半導体ウエハのハンドリング装置であって、ハンドのアーム側フィンガ部分の両端の点が中心点になす開き角を、半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角の２倍以上とし、それぞれの両端から中央部に向けてオリフラの前記開き角以上移動した点までをハンド把持部とし、接触点を少なくとも両端とそこから中央に向けてオリフラの前記開き角以上移動した点の４点とし、ハンドの先端側把持部の両端の点が中心点になす開き角を半導体ウエハのオリフラ部の両端の点が半導体ウエハの中心点になす開き角以下とし、接触点を少なくとも両端の２点または中央の１点とし、オリフラの位置がフィンガ部分のどの位置にあっても、半導体ウエハを把持する際に、両方のハンド把持部がそれぞれ半導体ウエハと実際に最初に接触するであろう少なくともそれぞれ１箇所の

点を結んだ線と、それぞれの点を半導体ウエハの中心点と結んだ線がなす角度を、ハンド把持部と半導体ウエハとの摩擦角以上になるように設定したことを特徴とした半導体ウエハのハンドリング装置。

【請求項４】　請求項２または請求項３に記載の半導体ウエハのハンドリング装置において、ハンドのアーム側及び先端側把持部の接触部の縦断面形状を半導体ウエハが入り込む上部の入り口部分の面の傾斜を半導体ウエハを把持した際の半導体ウエハ中心に向けた急傾斜面とし、その勾配を半導体ウエハの平坦な底面の円形外周の直径に近い位置に至るまで保ち、それよりハンド中心に向かった内部は、アーム側、先端側共ハンド平面より同じ高さから中心に向かった水平に近い円錐状の緩傾斜面としたことを特徴とする半導体ウエハのハンドリング装置。

【請求項５】　請求項２または請求項３に記載の半導体ウエハのハンドリング装置において、ハンドのアーム側把持部の接触部の縦断面形状を半導体ウエハ入り口部である上部では垂直に近い内壁面とし、それぞれハンド平面より同じ高さから中心に向かった部分を水平に近い円錐状の緩傾斜面にし、該アーム側把持部はハンドに固定し、先端側把持部の接触部の縦断面形状を入り口部ではアーム側把持部と同様の内壁と緩傾斜面にし、該先端側把持部の接触部を、単数または複数個の把持部とし、ハンドの中心点またはアーム側把持部に向かって引かれたり離れたりする可動部分としたことを特徴とする半導体ウエハのハンドリング装置。

【請求項６】　請求項２または請求項３に記載の半導体ウエハのハンドリング装置において、ハンドのアーム側＊把持部の接触部の縦断面形状を半導体ウエハ入り口部である上部では垂直に近い内壁面とし、それぞれハンド平面より同じ高さから中心に向かった部分を水平に近い円錐状の緩斜面にし、該アーム側把持部はハンドに固定し、先端側把持部の接触部分の縦断面形状を入り口部ではアーム側把持部と同様の内壁と緩斜面にし、該把持部の接触部を単数または複数個の把持部とし、ハンドの中心部またはアーム側把持部に向かって引かれたり離れたりすると同時に引かれる直前または直後に引かれる方向に対して直角に起立し、離れる時は立ち上がったまま離れる方向に移動した後、移動最終端またはその直前に水平に戻る構造になっていることを特徴とする半導体ウエハのハンドリング装置。

【請求項７】　請求項１乃至６のうちいずれか１項に記載の半導体ウエハのハンドリング装置において、アーム側把持部の急斜面を垂直面とし、当該垂直面を先端側把持部の高さより半導体ウエハの厚さ以上に高くしたことを特徴とする半導体ウエハのハンドリング装置。

【請求項８】　請求項１乃至６のうちいずれか１項に記載の半導体ウエハのハンドリング装置において、アーム側把持部の高さを先端側把持部の高さより半導体ウエハの厚さ以上に高くしたことを特徴とする半導体ウエハのハンドリング装置。

【手続補正２】
【補正対象書類名】図面
【補正対象項目名】図２
【補正方法】変更
【補正内容】
【図２】

図2